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ARCHIVES OF OPHTHALMOLOGY.

OCULAR MANIFESTATIONS OF INTERNAL SECRETION.[1]

By Professor E. FUCHS, Vienna.

WHEN preparing this paper, I only became aware, how much had already been said and written about endocrine secretion in this country, which, by publishing the *Archives of Endocrinology*, of which a thick volume appears every year, has now taken the leading part in this line.

I have followed the development of the new science from its very start. When I graduated, not even the function of the thyroid was known. The first observations of troubles, following its removal, were made, long before Kocher, in Vienna by Weiss, who described tetany as a sequela of the operation. Eiselsberg in Vienna was the first to study the function of the thyroid experimentally by removing the gland of sheep and the books of Biedl and Falka of Vienna are still to-day standard works on endocrinology.

The ductless glands are innervated by the vegetative nervous system and act through this not on individual organs, but on the tissues. How deeply they may in this way influence the whole organism, is illustrated by gigantism due to hyperfunction of the pituitary gland. But not only the

[1] An address delivered before the City Medical Society of Baltimore and the Ophthalmological Section of the State Society of Maryland, March 29, 1922.

development of the body, but also character, attainments, affections, and sleep have been attributed to internal secretion. Without denying that it may play a part, I think that it is of no use to discuss it as long as no evidence whatever can be brought forward for it. I shall therefore stick scrupulously to those manifestations of internal secretion, for which there exists at least a certain amount of probability.

For evidence to be conclusive, the symptoms of hypofunction, following extirpation of the gland, should be removed by the incorporation of the products of the same gland, and the administration of these to a healthy individual should be followed by the symptoms attributed to hyperfunction. This requirement has been fulfilled only in a very few instances and scarcely ever with regard to the eye. Even the most striking ocular manifestation of hyperthyroidism, the exophthalmus, could only very exceptionally be produced by introduction of thyroid substance.

The *difficulties of investigation* on the subject in hand are mainly due to two facts. The first is, that up to to-day only of two glands has the active substance been isolated, thyroidin and quite recently crystallized tyroxin of the thyroid, and adrenalin of the adrenals. Of these and of the other ductless glands Abderhalden claims to have recently obtained the active substances in a perfectly hydrolyzed form, which he terms opton. In the second place the correlation, which exists in a stimulating or inhibiting form between the individual glands, makes it impossible to tell, if the symptoms, following for instance extirpation of one of them, are to be attributed exclusively to it or in some part also to one of the other glands influenced by the extirpated one.

Among the *methods of investigation* the *experimental* takes the first place. The most ancient experiment dates from antiquity, showing the sequelæ of castration in man and animals. The counter-test to extirpation is the implantation of gland or the incorporation of gland substance in some form. Another way of evidencing experimentally the correlation between different organs is Abderhalden's method, about the reliability of which opinions are still divided.

The second means of investigation is *clinical observation*. Not most trustworthy is the observation of the clinical symp-

toms and then the study of the changes in the glands after extirpation or after death. Another way of clinical investigation is the observation of the therapeutic effects of the administration of gland substance in various diseases. Modern literature abounds in communications of this sort. In this respect I agree fully with Stewart, who says that the contrast is great, when we leave the desert, where the physiologists and experimental pathologists have wandered, striking many rocks, but finding few springs, and pass into the exuberant land of clinical endocrinology, flowing with blandest milk and honey almost suspiciously sweet.

The beneficial effect of drugs derived from glands is conclusive only, if it has been obtained in numerous cases and with a certain amount of regularity, as for instance the thyroid treatment of cretinism. Otherwise we ought to bear in mind that to cases reported as treated successfully corresponds doubtlessly a manifold greater number of unsuccessful cases, these being as a rule not published. Again, the apparent success may be due to suggestion or to an accidental coincidence with spontaneous relief. And even if the success in a given disease could be attributable to the gland drug, it would by no means be a proof that the disease is due to a trouble of this gland. Haskins is right in asking, whether because cascarin is efficacious in relieving constipation, we ought to conclude, that this is because the patient is suffering from hypocascarism. The fact that a harmful effect of glandular drugs is extremely rare and as regards the eye is known only of the abuse of thyroid preparations, ought to make us cautious as to their therapeutic efficiency in general.

Contrary to much that has been said and printed on ocular troubles due to the ductless glands, those troubles which occur so often that their relation to the glands may be said to be ascertained are but very few. Many of the ocular symptoms related of cases of glandular disease have been observed only occasionally, so that it cannot be excluded that they may be only indirect consequences of the glandular trouble, as for instance retinal hemorrhages from increased blood pressure in consequence of an excess of adrenalin in the blood. In some of the cases also a mere coincidence is possible. I shall also exclude from the following statements mere

mechanical damages, as for instance atrophy of the optic nerve from pressure by an enlarged hypophysis. I am going now to review the ductless glands, summarizing their action on the eye.

1. The *thyroid* is supposed to act as a stimulant on the thymus, adrenals, and gonads and inhibitorily on the pancreas, hypophysis, and parathyroids. Thyroid preparations have no direct influence on the pupil, only an indirect one in that in cases of Graves's disease the dilatation of the pupil by adrenalin is obtained more easily. Abderhalden asserts that his opton of thyroid together with that of testis contracts the pupil of an excised frog's eye, the only instance of miosis effected by organic drugs. The general action of the thyroid is supposed to be in the main threefold. The first is the *acceleration* of *metabolism*.

In exophthalmic goiter the metabolic rate is increased, which accounts for the emaciation of such patients in spite of copious feeding. In the eye the accelerated metabolism manifests itself through the intraocular tension. Hertel showed that after intravenous injection of some cubic centimeters of a 10% solution of chloride of sodium the tension of the eye drops. The increased osmotic tonus of the blood causes water to pass from the eye to the blood by diosmosis, diminishing in this way the intraocular tension. I used this procedure sometimes in cases of acute glaucoma with so high a tension that I apprehended an intraocular hemorrhage at their iridectomy and I succeeded by it in reducing the eye tension considerably, for instance from 60 to 40*mm* mercury. Again Hertel stated that in animals with symptoms of exophthalmic goiter or fed with thyroid, the injected salt solution disappeared sooner from the blood and the intraocular tension took less time to rise to its former level. On the contrary after extirpation of the thyroid the diosmotic exchange between eye and blood was protracted and the diminution of tension after the injection of the salt solution was less or even nil. Accordingly he found in cases of Graves's disease the tension in general low, averaging 16*mm* mercury, whilst in cases of hypothyroidism with myxœdema the tension was in the average higher, between 29 and 31*mm*, and in two of the cases symptoms of glaucoma were present. These latter cases responded to thyroid treatment by a reduction of tension,

in one case from 26 to 16*mm*, in the other from 40 to 18*mm*. The relation between glaucoma and thyroid is supposed to be due to the influence of the gland on the salt metabolism. In glaucoma cases the salt in the blood amounted to 0.72% against 1.13% in healthy persons. Also Imre got good results by thyroid treatment in glaucoma and he found the tension lower during pregnancy, when the thyroid is enlarged. Abderhalden by his method found thyroid trouble in glaucoma cases.

Another effect of the thyroid is probably the *destruction* of *toxins*, which are produced by the normal metabolism and poured into the blood. Animals can be immunised against the 2 to 10 fold quantity of various toxic substances by feeding with thyroid. The increase of metabolism and with it of metabolic toxins during pregnancy is counterbalanced by an increased function of the enlarged thyroid. But if this increase of function should remain behind the demand then the toxins might accumulate in the blood and cause general and local disturbances. In this way albuminuria as well as retinitis and optic neuritis, occurring sometimes during pregnancy, have been accounted for. But these may just as well be attributed to the *action* of *toxins* produced in excess by the enlarged thyroid. At least the cases of optic neuritis after thyroid treatment for obesity point in this direction. Birch-Hirschfeld and Inouye observed atrophy of the optic nerves, together with degeneration of the ganglion cells of the retina in dogs after feeding with thyroidin, just as it can be produced also by other toxic substances such as quinine, salicylates, etc. Also in cases of exophthalmic goiter papillœdema, optic neuritis, and optic atrophy have been recorded.

The ocular symptom most regularly met with in Graves's disease is the *exophthalmus*, but just this has been obtained but very exceptionally by excessive feeding with thyroid. There is no consensus of opinion as yet as to the immediate cause of the exophthalmus and it may even be that it is not directly dependent on the thyroid, but on some other gland influenced by the thyroid. It is especially the thymus which seems to play a part in exophthalmic goiter and cases treated unsuccessfully by extirpation of the thyroid got well after extirpation of the thymus.

The sequelæ of ***hypofunction*** of the thyroid are well known as myxœdema and cretinism, but the eye is only very rarely affected. Treacher Collins relates a case of myxœdema in which a central keratitis developed, which responded well to thyroid treatment. Then cases of cataract, choroiditis, retinal hemorrhages, and optic neuritis with subsequent atrophy together with myxœdema are on record. After extirpation of the thyroid in man cataract and optic neuritis have been observed, after extirpation in dogs interstitial keratitis. But with regard to the numerous cases of myxœdema, cretinism, and operative removal of the thyroid the recorded cases of eye lesion are so few that it is difficult to exclude indirect action or mere coincidence.

Successful treatment with thyroid preparations has been recorded in cases of corneal dystrophy, chronic uveitis, recurrent hemorrhages in the vitreous body, retinitis pigmentosa, and others.

2. The ***parathyroids*** are said to inhibit the function of the thyroid. Their extract does not affect the pupil. To date we know nothing about the symptoms of hyperfunction of these glands. The sequelæ of ***hypofunction*** could be studied only after experimenters had learned to extirpate these glands separately. Before they had always been removed undesignedly together with the thyroid, so that the subsequent symptoms referred to the deficiency of both glands. Nowadays we know that the complete removal of all parathyroids is always followed by death from tetany. If enough of parathyroid substance is left behind to keep the animal alive, the operation is followed by an increased excitability of the nervous system, by a reduction of the lime salts in the bones (rickets), and by nutritional disturbances of epithelial tissues such as hair, nails, teeth, and lens.

As to the nervous system, Falta observed during attacks of tetany an increase of refraction amounting to 3 to 4 dioptries, attributable to a spasm of the ciliary muscle. In the optic nerve neuritis had been recorded in some cases of tetany. With regard to epithelial structures, Hanke found an œdematous condition of the retinal epithelium of the iris as in diabetes and Peters and Possek observed changes in the retinal epithelium of the ciliary body in cases of zonular cataract,

which is supposed to be another consequence of parathyroid insufficiency. It has been known a long time that zonular cataract occurs in children with bad teeth from deficiency of enamel and suffering from rickets and convulsions. These latter have been recognized as being due to infantile tetany and Escherich found at postmortem examination of such children the parathyroids altered. So it is very probable that also the zonular cataract is due to parathyroid hypofunction. Hesse found in 81% of all his cases of zonular cataract symptoms of tetany, and amongst 41 cases of tetany 4 times zonular cataract. Extirpation of the parathyroids in rats is also followed by opacification of the lenses. The tetany in adult persons sometimes causes the development of a soft cataract and the cataract occurring in pregnant women is likewise mostly due to pregnancy tetany. So the correlation between cataract and parathyroid hypofunction is quite definite, but it is still unknown if we have to do with a direct action of certain chemical substances on the lens or with an indirect nutritional disturbance by the intermediary of the altered ciliary epithelium.

According to Fleischer the cataract in cases of myotonic dystrophy is attributable to faulty internal secretion, according to Fischer presenile cataract in general is due to parathyroid hypofunction, and I. Schiotz goes so far as to attribute all cases of cataract whatever to disturbances of internal secretion, but these are but conjectures without the slightest evidence.

3. Of the *pituitary* gland only the anterior glandular lobe has an internal secretion. This is supposed to stimulate the gonads and suprarenals and to inhibit the thyroid. After extirpation of the latter the hypophysis increases in size and so it does under just the opposite condition, namely together with the enlargement of the thyroid in pregnancy. Infundibulin dilates the pupil of an excised frog's eye. Abderhalden's pituitary opton is said to promote the adrenalin mydriasis.

Hyper- and hypofunction of the pituitary gland are followed by very manifold and severe sequelæ concerning the whole body, but no direct action on the eye is known, the affection of the optic nerves in cases of hypophyseal tumor not being due to internal secretion, but to pressure. Experi-

ments with excessive feeding of animals with pituitary extracts did not cause any eye troubles.

4. The *thymus* is supposed to inhibit the thyroid and gonads. Hyperfunction of the gland is presumed to be present in cases of status thymico-lymphaticus and in some cases of Graves's disease. The gland has been found enlarged in some of the latter cases and its removal had a favorable influence on the disease. Implantation of thymus in animals sometimes caused symptoms of exophthalmic goiter. Apart from the eye symptoms accompanying the latter disease no other correlation between eye and thymus is known.

5. The *gonads* stimulate the thyroid, thymus, hypophysis, and adrenals and inhibit the pancreas. The extract of corpus luteum dilates the pupil of a frog, the extract of ovary has no influence upon the pupil. As already has been said, Abderhalden's opton of testis plus opton of thyroid contracts the frog pupil.

A direct influence of the internal secretion of the gonads on the eye could not be found experimentally nor be evidenced by clinical observation. Many of the old observations, for instance of optic neuritis or atrophy from sexual excesses, are inaccurate and others, like the coexistence of ocular diseases with troubles of the menstruation, the recurrence or deterioration of inflammation, the appearance of acute œdema, etc., with each menstruation, are doubtlessly exact, but do not necessarily imply a direct action of the secretion of the gonads on the eye. The function of the ovaries certainly plays a part in the ætiology of Graves's disease, but also here we have very likely to do with an indirect action through the intermediary of the thyroid. Also the therapeutic effects obtained sometimes in eye diseases by gonad extracts must probably be considered as acting only indirectly on the eye.

Certain diseases of the eye are met with predominantly in members of one sex only. So in young men the recurrent hemorrhages in the vitreous body and the familial optic neuritis known as Leber's disease, in older men tabes with optic nerve atrophy. In female patients Graves's disease, interstitial keratitis, and especially chronic uveitis are more frequent than in men. The influence of sex cannot be denied, but it is yet impossible to tell whether the predisposition of

the tissues of the eye to certain diseases is due to a direct action of the internal secretion of the gonads or is effected by the intermediary of other factors.

6. In the *pancreas* an internal secretion is attributed to the islets of Langerhans. It is supposed to inhibit the function of the thyroid, gonads, and adrenals. Nothing is known about an effect on the pupil, nor of the possible consequences of a hyperfunction, only the hypofunction having been recognized as the cause of pancreas diabetes. The ocular troubles connected with diabetes are numerous: paralysis of extrinsic and intrinsic eye muscles, change of refraction, alteration of the retinal epithelium of the iris, cataract, inflammations as iritis, retinitis, and neuritis, finally high grade hypotension in diabetic coma. It is probable that most if not all of these changes bear only an indirect relation to the atrophy of Langerhans' islets.

7. The *adrenals* stimulate the thyroid, hypophysis, and gonads and inhibit the pancreas. Loewi was the first to find, that adrenalin dilates the pupil in diabetic patients, and in patients suffering from Graves's disease. But also in healthy persons dilatation of the pupil can be obtained by a very free application of adrenalin into the conjunctival sac and still better by subconjunctival or intravenous injection.

The function of the adrenals is still very much in the dark. Complete extirpation is always followed by death. But life is preserved if only a small portion of the cortical substance is left, the medulla being completely removed. Similarly post-mortem examination of persons who during life were apparently healthy revealed the destruction of both adrenals except for a small portion of the cortex. Now it is just the medulla which is secreting the adrenalin.

The clinical evidence of increased production of adrenalin is given by increased blood pressure, which in its turn may indirectly entail consequences also in the eye. The clinical symptom of hypofunction of the adrenals is Addison's disease. The eye is as a rule not affected in this disease except for a pigmentation of the conjunctiva recorded in a few cases. Uhthoff describes a particular form of keratitis with Addison's disease. This being to date the only case known, it does not allow of a conclusive assertion of a relation between the two affections.

No ocular symptoms attributable to altered secretion have been recorded in cases of affection of the ***pineal*** gland.

After what has been said, the eyes are only exceptionally affected directly by alterations of the internal secretion of the ductless glands. It may be that also there exists a relation to internal secretion in the following diseases:

Osteopsathyrosis, frailty of the bones, is as a rule accompanied by a particularly thin, blue sclera. In osteopsathyrosis as well as in osteomalacia the amount of lime salts in the bones is diminished, which may be due to a disturbance of the parathyroids as in rickets.

In cases of ***keratoconus*** several authors found by Abderhalden's method a relation to ductless glands, but with considerable discrepancy as to which of them. The ***green color*** of the cornea observed in rare cases of disseminate sclerosis and of tabes may bear some relation to internal secretion. Partial ***alopecia*** is found sometimes as a consequence of hypofunction of the hypophysis. Therefore such a relation may also exist in some cases of general alopecia, which is sometimes accompanied by iridocyclitis.

Some gland trouble may play a part in ***hemeralopia***, in the epidemic cases, occurring chiefly in spring, as well as in the chronic cases in consequence of liver disease. In the latter cases there develops eventually a pigmentation of the retina similar to that in ***retinitis pigmentosa***, which had also been attributed to some glandular disturbance.

Internal secretion in a wider sense of the word is not confined to the ductless glands. Every organ pours into its lymph vessels the products of its metabolism, which are different according to the tissues from which they come, and which, being ultimately effused into the blood, act through it on all the other organs and tissues of the body. To be efficient, very small quantities of this substance may suffice, as we see by the powerful influence exerted on the whole body by so small an organ as the pituitary gland. But if there is no doubt about the existence of an internal secretion in the above sense, its manifestations in the individual organs are still in the dark. But besides the general action through the blood stream every organ and every tissue influences the contiguous tissues by the products of its metabolism. This mutual influence

of adjoining tissues upon each other plays doubtlessly a most important rôle in embryonic development. The experimental embryology initiated by Roux has already revealed a great many such correlations, which, as far as they concern the eye, may be reported here in accordance with the experiments by Fischel and others.

In larvæ of amphibia the epithelium of the skin contains besides the epithelial cells particular cells termed Leydig's cells and furthermore pigment granules, either within the epithelial cells or in special cells, the melanophores. But where the epithelium passes from the skin over to the cornea, the pigment granules in the epithelial cells, the melanophores, and the cells of Leydig disappear, because they would interfere with the transparency of the epithelium and be therefore disadvantageous to good sight. Now if you transplant the eye to any other place under the skin, then the above cells and pigment granules will not develop in this part of the skin, or if already developed, will disappear, so that the epithelium becomes like the normal corneal epithelium. It is not even necessary to transplant the entire eye; the lens or a portion of the inner tunics of the eye, nay even the juice of the eye is sufficient for the purpose. This proves that we have to do with a chemical action of one tissue upon the other. The counter test to the above experiments is made by removing the eye, leaving behind only the cornea. Then its epithelium gradually becomes like the epithelium of the skin by developing Leydig's cells and pigment granules or melanophores. This proves that the chemical substances passing from the interior of the eye into the corneal epithelium are indispensable not only for its development as a transparent epithelium, but also for the permanent maintenance of this property.

The chemical influence of the contents of the eyeball manifests itself also on the lens. The lens is formed by a circumscribed proliferation of the ectoderm, where it stretches over the eye, the stimulus to this proliferation being given by the chemical substances emanating from the ocular vesicle. Therefore in larvæ of amphibia a lens may develop practically at any part of the skin, if the eye is transplanted under it, and the size of this lens will depend on the extent of the contact between skin and eye. In these larvæ also the

retinal epithelium on the posterior surface of the iris is capable of producing a new lens, if the normal lens has been removed. Also this is dependent on the chemical influence of the other tissues of the eye. If the iris alone is transplanted somewhere under the skin, it does not produce a lens, but it does so if a piece of retina has been transplanted with it. That they are really chemical substances, to which is due the proliferation of the epithelial cells in such a way that a lens is formed, is proved by the fact that it is possible to stimulate by the exclusive application of certain chemical substances the retinal epithelium of the iris so as to produce a rudimentary lens, just as Professor Loeb succeeded in effecting fertilization of the eggs of sea-urchins in a purely chemical way.

The influence of the chemical substances furnished by the contents of the eye is indispensable not only for the formation of the lens, but also for its maintenance. If the lens of a larva of a salamander is transplanted into another tissue, it gradually disappears by absorption, but if a piece of retina is transplanted with it, it is preserved. The absorption in the first case cannot be attributed to insufficient nutrition, because also in the normal eye the lens is nowhere in immediate contact with blood vessels. Could it be that the senile cataract is due to the fact that the chemical substances, necessary for the maintenance of its transparency, become insufficient with old age?

Evidently the facts found experimentally on larvæ of amphibia could not be simply applied to the human eye. But I may be allowed to describe some conditions which at least remind one remotely of what is so manifest in lower animals, and which cannot be explained except in the same way, namely by the chemical influence of contiguous tissues upon each other.

A recent cicatrix of the cornea is a fibrillous tissue with numerous nuclei. Gradually the latter become less and less and the fibrillæ coalesce so as to form lamellæ, which ultimately may become so homogeneous that under the microscope the old cicatrix looks nearly like corneal tissue, and has also become transparent to a certain extent (clearing up of a cicatrix), a change unknown in cicatricial tissue in other parts of the body. It must therefore be attributed to the influence

exerted by the adjoining structures, either the normal corneal tissue, preserved in the proximity of the cicatrix, or the aqueous humor. The first can be excluded by the fact that the same transformation into a cornealike tissue sometimes also takes place in corneal staphyloma. Now this originates not from the cornea, but from the iris, and the cornealike places are just found in the central parts of the staphyloma, most distant from the rest of the cornea at the margin. So it must be the influence of the aqueous humor and the substances dissolved in it, to which the ultimate transformation of the cicatricial tissue is due.

Another change in an old staphyloma and sometimes even in very thick cicatrices of the cornea is probably caused by the contrary condition, namely an insufficient action of the aqueous humor. In a very thick staphyloma the anterior surface has often a skinlike structure, with papillæ and a thick epithelium with superficial keratinisation. This condition may be found in cases with normal closure of the lids, so that it could not be attributed to exposure and exsiccation. The skinlike structure of the corneal epithelium must therefore probably be accounted for in the same way as the transformation of the corneal epithelium into ordinary epidermis after removal of the eye in amphibial larvæ. We may assume that in a thick staphyloma with its dense tissue the aqueous humor, diffusing into the staphyloma, does not get at the epithelium in sufficient quantity to maintain its normal condition.

Also the above experiments on the lens of amphibia have their analogy in the human eye. After the removal of the lens, out of its capsule, for instance after the extraction of a cataract, some lens matter always remains behind at the equator of the lens and even undergoes further growth by proliferation of the capsular epithelium. This is an attempt to regenerate the lost lens, a process which goes much farther in animals than in the human eye, where develops only a thin ring of lens substance, called Soemmering's ring. This however remains there for a lifetime and a complete absorption of the lens never takes place. On the other hand, if the lens is transplanted under the conjunctiva, as occurs sometimes incidentally in cases of subconjunctival rupture of the sclera, then not

only no attempt at regeneration is made, but the lens is gradually completely absorbed. This is contrary to what one might expect, the nutrition of the lens imbedded in the vascular tissue of the conjunctiva being better provided for than in its normal place, where no vessels get near it. But here it stays under the influence of the substances secreted by retina and uvea, which are absent in the lymph of the conjunctiva.

Another instance is the formation of hyaline membranes within the eye. In the normal eye, Descemet's membrane, the lens capsule, and the basement membrane of the choroid are homogeneous membranes, supposed to be a sort of cuticula produced by the cells that are lying on them. Defects in these membranes may be filled in by a new hyaline membrane after proliferation of the above cells, by which then the new membrane is furnished. But sometimes such membranes form also in other places. In old cases of iritis the iris is sometimes covered by a homogeneous membrane, just like Descemet's membrane. Also from the pigment epithelium originate sometimes hyaline membranes. It reminds one of a sclerosed vessel, where quite a number of new elastic membranes develop often within the connective tissue, which lies on the inner elastic membrane. Just as these elastic membranes are formed under the influence of the blood, so in the eye the hyaline membranes develop under the influence of the substances dissolved in the aqueous and vitreous humor.

RELATIONS BETWEEN EYE AND EAR (INCLUDING THE VESTIBULAR ORGAN)[1]

By Professor J. VAN DER HOEVE, Leiden, Holland.

AS I have to speak to oto-aryngologists as well as to ophthalmologists I, of course, looked for a subject which would divide as well as unite the different branches of medical science. In doing so the first things which appeal to our mind are the relations between the nose and the accessory sinuses to the eye, because these cavities are so close to the orbit and optic nerve. The ear is at so great distance from the eye that it seems nearly impossible that direct influence is exercised from one organ on the other, and yet I, for one, believe that the relations between eye and ear, at least when we include the vestibular organ, are of much greater importance to mankind than those between nose and eye.

My subject may be divided into four parts:

1. Diseases and intoxications, which cause eye and ear symptoms.
2. Eye diseases which cause ear symptoms.
3. Ear affections which give eye symptoms.
4. Relations between the vestibular organ and the eye.

I will try to pass the three former quickly so as to spend the greater amount of my time on the last and most important one.

We all know that there are a great many diseases and intoxications which cause eye and ear symptoms. From the latter we can, for instance, mention intoxications with chinin, optochin, salicyl, wood alcohol, etc., from the former, the well-known ones as syphilis, especially the hereditary form, tuber-

[1] Read before American Academy of Ophthalmology, Otology-Laryngology, Philadelphia, October, 1921.

culosis, scrophulosis, etc. But I only wish to fix your attention for a few moments on some lesser known and yet important diseases; in the first place, on the syndrome of blue sclerotics.

You know that in 1901 Eddowes taught us, in a very short publication, the existence of a hereditary disease, in which the patients have a grey-blue to slate-blue color of the white of the eye, and suffer of brittle bones. That means that they fracture different bones on the slightest occasion as by putting on an overcoat, falling on a feather bed, etc.

Eddowes had previously supposed that this was due to a lack of fibrous tissue. Eddowes's communication was forgotten and later on the facts rediscovered. Since then many authors have produced a great number of accounts of this interesting disease without showing new facts until about four years ago de Kleyn, from Utrecht, and I found that these patients when getting older grew deaf by otosclerosis, or labyrinth affection. At nearly the same time this fact was also found out by an American man named Bronson, who was then in Edinburgh. Since then it has been investigated by different authors.

I am convinced that the sufferers from blue sclerotics have nearly always also brittle bones and ear affection, but in the literature you will find that of those afflicted with sclerotics many have brittle bones, and some of them deafness. This may be caused by the fact that when the blue sclerotics are present it is observed immediately, but brittle bones may pass unobserved when no traumatism occur and patients only become aware of otosclerosis at an older age.

The cause is a maldevelopment of the mesoderm. There are other infirmities which may occur, as arcus corneæ juvenilis, sprains, weak ligaments, etc. The patients often are small, crooked persons. The girl, whose picture I show here, had about twenty-seven fractures of different bones, *e. g.*, of the sacrum, legs, skull, etc. The most interesting feature is the affection of the auditory organ. You know that only a few years ago we thought that the inner ear could not be photographed with Roentgen rays in such a way that the photographs could be used for clinical purposes, but Stenvers, from Utrecht, taught us otherwise. You see here in a skull the inner ear made more visible by filling with lead; here in a skull without that filling you can see clearly the cochleæ, the semicircular

canals, the cavum tympanum, and the meatus auditivus internus. On the next lantern slide you see the same in a normal living person and here in a patient with blue sclerotics and otosclerosis, we find in the place of the inner ear a black mass in which we can only find a few remains of the labyrinth.

We know that in those rare cases the relation of eye and ear is of some value. Then it is necessary when a patient comes to us with blue sclerotics to advise him not only not to take a profession in which he is exposed to traumatism on account of the brittle bones, but also to warn him that his hearing will get worse when he grows older; so that professions in which acute hearing is of great importance, such as telegraphist, marconist, telephonist, etc., had better not be chosen.

In the second place, I wish to mention the eye affections which are often found in congenitally deaf and dumb people, as pigment degeneration of retina either in the form of the well-known retinitis pigmentosa, or in other forms.

It may be of some interest on this account to mention that in the ophthalmoscopical examination of congenitally deaf and dumb animals, such as the Japanese or Chinese dancing mouse, I found in every specimen I could lay my hands on, a pigment degeneration of the retina, sometimes very much like a retinitis pigmentosa, other times more like an old chorioretinitis.

Though this fact is very easily ascertained by means of the ophthalmoscope, the histological investigation is not so easy, but I hope we will be able to prove this fact anatomically, too. At any rate, both facts show a very intimate connection between retinal pigment and deafness.

I shall attempt to give still a third instance of diseases with eye and ear symptoms: We know a peculiar disease under the name of tuberose sclerosis of the brain, in which as a rule young epileptic idiots have tumors and cysts in the brain, heart, kidneys, thyroid glands, and in the skin. I have observed that in this disease may also be found previously unknown tumors of the optic nerve head and of the retina.

Now there is a second nerve disease which we know under the name of the disease of Recklinghausen, which manifests itself by multiple neurofibromata in the skin and in the peripheral nerves and even in the acoustic nerve.

Some neurologists, as Bielschowsky, think that both diseases are one and the same, only with different localization of the tumors and consequently they speak about spongioblastosis centralis, phrenica, and universalis. Nieuwenhuyse, on the contrary, is convinced, that those diseases are two entirely different well-defined affections, not to be classed together.

A few months ago I examined in the clinic of Professor Winkler, in Utrecht, a patient, who was deaf, feeble sighted, and showed atrophy of many muscles. A diagnosis of meningitis, with consequent deafness and muscle atrophy, was made, but when Stenvers made X-ray photographs of the inner ear to find out what was amiss, he discovered on both sides a considerable enlargement of the porus acousticus internus, which, as you can see in these diagrams, enlarged as age advanced, so it was made highly probable that the deafness was caused by a tumor of the acoustic nerves. The patient was reëxamined and they found some neurofibromata on his back and in certain other places. The diagnosis was therefore changed to Recklinghausen's disease.

The right eye of this man was already feeble-sighted for many years; there had been a retinal detachment. We found in the retina a huge mass which looked like advanced stage of Coates' disease but it could also have been a tumor mass. At the place of the optic nerve disk there was a tumescence, which could have been a tumor of the optic disk. However, this eye was much too changed to make a reliable diagnosis. The other eye showed a choked disk (5 Diopters) but also in the retina were two small tumors ophthalmoscopically exactly like the tumors in the cases of tuberose sclerosis of the brain.

Though the real proof can only be given by histological examination of the eye, I am thoroughly convinced that this man has the same kind of tumors in the retina as our patients with tuberose sclerosis show. If this proves to be true, it is highly probable that the disease of Recklinghausen and the tuberose sclerosis are the same affection, or are at least very near to each other. Then, too, it would not be accidental that such rare tumors would develop in different diseases. So you see again how important the eye and ear symptoms are. The ear disease enabled us to make the diagnosis of Recklinghaus-

en's disease, and the eye disease can perhaps help to solve this neurological puzzle.

2. About eye diseases causing ear diseases we may be brief, because I know only one: Sympathetic ophthalmia, which is said to be the cause of deafness. The first who observed this fact, Snellen, thought the deafness to be caused by a meningitis spreading from the optic nerve sheaths, because they believed in Deutschmann's theory of the migration of sympathetic ophthalmia along the optic nerve sheaths. Nowadays this theory has become more or less obsolete and other theories more popular.

Peters, who believes that deafness is not a very rare occurrence in sympathetic ophthalmia, tries to explain the deafness by one of the modern theories and he chooses Elschnig's theory, which says that sympathetic ophthalmia is an anaphylactic process in sequence of sensitization of pigment caused by the inflammation in the first eye. Now it is possible that just as the pigment in the second eye, the pigment in the labyrinth is sensitized and causes the ear disease. The individual difference in the amount of labyrinthal pigment can explain why one gets deaf and the other not.

I cannot say that I have often found deafness in sympathetic ophthalmia, but this theory shows again how close a relation is thought to be present between eye pigment and the ear, and I am thoroughly convinced that this relation is a very important one. So we often encounter deafness in albinotic animals, for instance, white cats. As a rule these cats have blue irides, which means that they are not absolutely albinotic, whereas total albinotic cats are not deaf. This is also the case with mice. Totally albinotic white mice are not deaf, whereas the partial albinotic dancing mouse is deaf.

Concerning these relations between eye pigmentation and deafness there are different possiblities:

1. The pigment aberration causes the deafness;
2. The ear disease causes the pigment aberration;
3. Both are independent of each other and may come from the same origin.

The first is perhaps the case in sympathetic ophthalmia. About the second possibility, Peters suggests that the eye pigment may be sensitized from the labyrinth, which gives rise to

a spontaneous bilateral iridocyclitis; this supposition lacks supporting evidence.

von Stein thought that the relation between eye pigment and labyrinth is so close a one that whenever he destroyed one labyrinth in guinea pigs, he observed pigment changes in both eyes; by destruction of the cochlea he could cause pigmentation as well as depigmentation of the eye, so that he supposed there was present in the cochlea a trophic center for the eye.

I cannot believe the relation between ear and eye pigment to be so close and simple, because de Kleyn—in a great number of guinea pigs, rabbits, and cats, in which for another reason one labyrinth was destructed—could never observe changes in eye pigmentation, neither early after operation, nor weeks nor months later. We had the same negative results in observing human beings where the labyrinth was destroyed by disease; so that we came to the conclusion that in congenital labyrinth deafness often, in acquired only very seldom, pigment changes in the retina may be found and that it has not yet been proved that the pigment changes are dependent on ear diseases.

We are already in the midst of our third part; the influence of the ear on the eye. Here I will not speak about choked disk, due to acoustic tumor or otogenic encephalitis or meningitis, but mention some other diseases: In the first place, thrombosis of the cavernous sinus. Every ophthalmologist should always bear in mind that this usually deadly disease may have its origin in otitis, so that as soon as we can make the diagnosis of this terrible disease, or suspect it, we ought to consult with an otologist, because as I know from experience, operation of the ear may sometimes prevent the fatal issue.

Another eye-symptom caused by an ear disease, which occurs more frequently, is paralysis of the abducens nerve in otitis media. Some time ago I saw a most striking instance of abducens paralysis caused by otitis media. A village doctor sent a boy with palsy of the right sixth nerve, and the statement that he had observed purulent secretion out of the right ear. When the boy came to Leiden the purulent secretion had stopped entirely and the otologists could not find the least symptom of otitis media, even no scar nor perforation in the tympanic membrane. The boy was taken in my ward and

two days later the purulent secretion reappeared and the paresis was much better. A very small perforation was observed in the tympanic membrane. The secretion stopped again and the paresis was worse. This recurred several times.

What is the relation between the palsy and the otitis? Gradenigo thinks that the palsy is due to a meningitis at the top of the os petrosum; others speak about the pressure caused by inflammatory œdema and venous stasis in the narrow slit of Dorello, where the nervus abducens passes through the sinus petrosus superficialis. I, for one, believe that toxins play a part by spreading of the toxin in the neighborhood of the focus, so that as soon as the free exit of the pus was blocked the paresis was worse because of toxic œdema. It is like the affectation of the optic nerve in diseases of the accessory sinuses and like eye affections of dental origin.

To my conviction it is a little absurd to suppose that the toxins are absorbed by the fluids and run around the body to come exactly to the spot next to the focus to exercise their pernicious influence. It is much more probable, and quite according to the fact, to suppose that the least obstruction causes immediate exacerbation and that the toxic influence comes directly from the toxins spreading in the neighborhood of the focus.

The combination of ear disease and abducens palsy may also be found in cases of traumatism, so I show you here the Roentgen photo of a man, who after trauma of the head became deaf and had an abducens paralysis. We see a fracture in the os petrosum passing through the cochlea.

If we know that an otogenic pupillary and an aural palpebral reflex exists, then I think we may be sure enough that in daily practice may be found manifold relations between the eye and the ear worthy of our intense interest and we should always be aware of this in the interest of our patients and ourselves.

Much more important than those direct clinical relations between the real auditory organ and the eye, are those between the eye and the vestibular organ, which, though many of them have already found a place in our daily practice, are not only of clinical interest, but also of a high scientific signifi-

cance, as well from a physiological as from a pathological point of view.

VESTIBULAR ORGAN AND EYE.

The inner ear is composed of two different parts, which, though both are innervated by branches of the acoustic nerve, do not belong to each other. The real auditive organ, the cochlea, is innervated by the nervus cochlearis, and the vestibular organ by the nervus vestibularis. Formerly the vestibular organ was thought to be a part of the auditory organ and many a name still reminds us of this mistake. Since the classic experiments of Flourens, however, we know that the vestibular organ is a part of the organ of equilibrium, and it is only the very close and intimate anatomical relation which gave this organ as a precious treasure to the otologists, though it has become the place of huge mutual interest and the favorite working place for physiologists, neurologists, and ophthalmologists as well as of otologists.

The vestibular organ consists of the three semicircular canals and the two spaces which we call the utriculus and the sacculus. In the ampullæ of the semicircular canals we find the cristæ acousticæ, in which are the nerve endings of the nervus vestibularis in cells with trembling hairs, moving with the motion of the lymph in which they are floating. Every movement of this fluid acts as an excitation to the nerve cells so that those canals are the most excellent apparatus to perceive any motion of the head.

In the sacculus and utriculus we find the macula-acoustical nerve cells on which rests a membrane with calcareous impregnation, the so-called otolithic membrane, which in some animals, for instance, fishes, is so developed that we can speak of a real stone, the otolith.

The otoliths can exercise influence on the maculæ by pressing on the nerve cells or by dragging at them, consequently, the impulse which they cause will change by every change in position of the otolithic organ, and so the otoliths are an excellent organ to perceive a different position of the head in space. Numerous are the theories brought forward and the experiments done to explain the function of the vestibular organ, and

I have only to mention the names of Flourens, Mach, Breuer, Ewald, Kreidl, Kubo, and in recent times Barany. You know how Barany has made our knowledge concerning the function of the vestibular organ of use in our daily practice.

I think that probably the best work which has been done along this line is that done in the last ten years in the pharmacological laboratory in Utrecht by Magnus, de Kleyn, and their coöperators. This work is so important that Barany himself is always in correspondence with these Utrecht men to hear whether his hypotheses are confirmed by the fine experiments made at that place.

In the time which remains, I wish to tell you what Magnus found. The experiments were performed on animals—frogs, cats, dogs, guinea pigs, but especially on rabbits—with the purpose of obtaining an exact knowledge of the function of the vestibular organ in these animals and afterward in human beings, in whom these structures are quite different. The first thing which was necessary was to be exactly acquainted with the anatomy of the vestibular organ of the rabbit.

In the anatomical cabinet in Utrecht there were made by de Burlet serial slides of rabbit skulls, reconstruction in wax of skulls, membranous labyrinth, etc., and on the slides was made a mathematical drawing-reconstruction, which was controlled by Prof. Ornstein, with an analytical-geometrical formula system. In this way there was obtained an exact knowledge of the anatomy of the labyrinth of the rabbit.

According to the result of this examination a magnified model of the labyrinth was constructed. It was too large to bring with me but I can show you a model of the otolith apparatus only, which represents their real position in the rabbit skull. The maculæ acousticæ are represented by these colored plates; the otoliths by these leaden ones. You see that in giving the rabbit's skull different positions in space we can see what the position of the otolith is in any position of the skull. We know that the labyrinth can cause clonic and tonic reflexes in the eye muscles, so that nystagmus is produced by the clonic, whereas the position of the eye in the orbit is determined by the tonic reflexes.

Now Magnus and de Kleyn found that the labyrinth produces also tonic reflexes of the body muscles and they tried to

determine what reflexes were produced by the different parts of the vestibular organ. So Magnus and de Kleyn found that the vestibular organ causes a tonic contraction of the extensors of the limbs, maximal when the head of the rabbit was placed topsy-turvy, minimal when the head had its normal position with the mouth fissure horizontal.

This reflex was thought to be probably due to the utriculus otolith, so we see that the otolith causes the maximal extension of the limbs when it is dragging at the macula, no extension when it is pressing on the macula. The same otolith causes also extension of the neck muscles, with, of course, the same maximum and minimum positions; but there is an important difference between both reflexes.

The utriculus otoliths are in contact with the limbs of both sides, so that when one labyrinth is destroyed the reflex is not changed. Concerning the neck muscles on the contrary every otolith is only in contact with the muscles of one side, so that when one labyrinth is destroyed the reflex causes a bending of the neck. A third labyrinth reflex has as a consequence that the animal tries to bring back his head in the median position as soon as it has left this position. Magnus calls these reflexes Stell-reflexes.

They are probably caused by the main part of the sacculus otolith. Every sacculus otolith awakes a reflex, which tries to press the head in a direction opposite to the otolith. As long as the head is in the medial position, the influence of the otoliths on each side counterbalance each other, but as soon as the head is bent to one side, the otolith of that side is dragging stronger and so stimulating more, the other is dragging less and so stimulating less, so that the lowest otolith produces the greatest influence and presses the head back again in the median position, which he cannot pass, for in that case the influence of the other is gaining in strength as much as the first one loses its influence. If one labyrinth is destroyed the influence of the remaining sacculus otolith is no more counterbalanced and it will press the head to the other side, till the head assumes a horizontal position with the side of the remaining labyrinth above. Now the sacculus otolith presses on its macula and drags no more, so that this is the rest position which was seen in Flourens's experiments.

These reflexes have not only theoretical importance. We can find them under certain conditions in human beings, and they may be used for diagnoses. The reason why these reflexes are very difficult to demonstrate in animals and almost not to be observed at all in human beings, is that they are covered by voluntary movements and by other consequences of brain action. Therefore we can find them in animals the best when they are decerebrated. In human beings we find them when the brain does not act properly, for instance, in some children younger than three and one-half months of age, or when the brain is partly diseased. Magnus and de Kleyn have studied the direction the reflex movement takes, and so we can conclude when the reflexes are present which part of the brain is still acting. These reflexes were found in patients with idiocy, meningitis, hydrocephalus, apoplexy, and coma diabeticum. As a rule it is an ominous sign when these reflexes can be observed in brain disease.

But I should speak about the relation of the eye to the vestibular organ. We said that the vestibular organ can cause tonic and clonic contractions of the eye muscles. The first determines the position of the eye in the orbit. de Kleyn and I tried to determine the different positions of the eye in the orbit when the head changes its position in space. For this purpose we marked the cornea of a rabbit with a cross figure; suspended the rabbit on an operation board, the head fixed firmly in a Czermak clamp. To this clamp was fixed a wire figure, so that when we photographed the cornea we could see by the cross figure and the wire figure if, and how much, the cornea had moved. The photographic apparatus was fixed on the same board.

This operation board was fixed in a wooden frame in such a way that it could rotate on an axis, and this frame again in another frame, so that it could rotate along an axis perpendicular to the first. In this way we could give the head of the animal any position in space we wished. When we turned the whole apparatus around a vertical axis the position of the eyes was not changed at all.

We now made three rotations:

Rotation I. Animal in vertical position, mouth fissure horizontal. Rotation of the animal on its bitemporal axis. Direction of rotation head down, tail up.

Rotation II. Vertical position, mouth fissure horizontal. Rotation of the animal on its occipito-caudal axis.

Rotation III. Animal in lateral position, mouth fissure vertical. Direction of rotation head down, tail up.

We made twenty-five photographs for every rotation of 360°; the animal was moved every time 15°. We waited until nystagmus caused by the movement was over. At the twenty-fifth determination the animal had come around again to its original position, so that the twenty-fifth photograph controlled whether any change of position due to other causes had taken place. It is clear that many of the positions in the three series are the same and so they controlled one another.

In this way we learned that by changing the position of the head in space the eyes deviate typically in vertical directions and rotate along the sagittal axis. We could not find out a typical horizontal deviation.

You see that the vertical deviation has its maximum when the animal is rotated on its side, that is, the eye of that side as high as possible, the eye of the upper side as low as possible. de Kleyn and Magnus explained this by the action of the main part of the sacculus otolith. Every sacculus otolith is in connection with the rectus superior of its corresponding and the rectus inferior of its opposite eye. As long as the head is in a symmetrical position the influence of each muscle counterbalances the other and so we see no, or nearly no, vertical deviation when the animal is rotating around the bitemporal axis. When, however, the animal leaves the median position, the lower sacculus otolith drags more at its macula, the upper less; consequently the eye of the lower side is turned up, that of the upper side downward.

If one labyrinth is destroyed the influence of the remaining sacculus otolith is not counterbalanced and the eye of the mutilated side is turned down, of the sound side upward. It is only when the head is rotated toward the mutilated side, so that the remaining sacculus otolith presses on its macula and exercises consequently no influence that the eyes return to normal position.

The rotation of the eye, the cyclotropia, is maximal with the point of the vertical to the nose when the nose is turned upward; maximal with the point to the ear when the nose is

turned downward. It was difficult to find out which otolith produced this reflex; neither the utriculus nor the main part of the sacculus otolith can do it. Now Magnus and de Kleyn tried to explain it by the action of the small bent part of the sacculus otolith. This part has not only a separate position nearing the frontal plane, but also a separate innervation; whereas the main part of the macula sacculi is innervated by the nervus sacculus, this part is innervated by the nervus utriculus, so it is no wonder that it has a separate action. When the head is rotated with the nose in a vertical position the small part of the sacculus otolith drags at its macula and gives a stimulus to the musc. obliq. sup. of both sides, so that the eyes rotate to the nose; when the head is rotated with the nose pointing downwards, these otoliths press on their maculæ and this produces a stimulus for the obliquus inferior of both sides. When one labyrinth is taken away, the reflex is the same in quality and not in quantity. The weak point of this explanation is that we have here for the first time to accept pressing on the macula as a stimulus, but it is possible that this explanation is good, though I have other objections to it.

This rotating reflex is called a compensatory rotation, because it seems to try to compensate the rotation of the head by the rotation of the eyes. That really the labyrinth is the cause of these deviations is proved by the fact that when we destroy the labyrinths the compensatory and vertical movements disappear when we examine the influence of the head movement without bending the neck of the animal.

I could also show that in the congenitally deaf dancing mouse these reflexes fail, and also in the two congenitally deaf and dumb girls. For the examination of the latter I used a Javal ophthalmometer with a rotatable head rest in which the head was fixed. We first determined the axis of the astigmatism of the cornea and then rotated the head with the head rest, for instance, 10°; when there is no compensatory rotation the axis of astigmatism is 10°. If there was compensatory rotation of 10° the axis would not have changed; if the axis was changed 3° there must have been 7° compensatory rotation, so we can determine exactly the compensatory rotation in astigmatic human beings and doing so we find that even the least rotation of the head produces compensatory rotation.

This is of importance for the ophthalmologist for it teaches us that we have always to put patients with their heads straight in the ophthalmometer, otherwise we do not find the right axis. This compensatory rotation is probably also the reason why astigmatic people often hold their heads rotated to one or the other side when they do not get the right correction. They try by this movement to rotate their eyes in such a way that they get their eyes in the best position behind their glasses.

We who like to know the cause of things ask ourselves what is the purpose of this compensatory rotation. When years ago this rotation was observed they thought it was to hold the vertical meridian of the eye vertical in every position of the head for better orientation, but this could not be accepted because the compensatory rotation was always less than the rotation of the head.

In rabbits, as you saw, it is the same, but we know that there is another influence which gives compensatory movement of the eyes, namely a reflex produced by the neck muscles. When the neck of the rabbit is bent the eyes rotate. Now de Kleyn examined both separately. The compensatory rotation is caused by the neck: by fixing the head and bending the body of the animal towards the head. The labyrinth rotative reflex was examined by us as described above. If de Kleyn put both compensatory rotations together, he learned, as you see, that a rabbit with the mouth fissure horizontal, head straight forward, could lift its head over 10° or bend it downward over 90° without rotation of the eye because the compensatory rotations compensate fully the rotations of the head.

At first de Kleyn was puzzled to know why this compensation allowed the head to be bent more than 90° and only be lifted 10°, but this was solved easily. It is caused by the fact that the normal position of a sitting rabbit is not with the mouth fissure horizontal, head straight forward, but with the head bent downward 35° so that out of this position the animal can lift the head over 45° or bend downward over more than 55° without the vertical meridian of the eye changing its direction, which is quite enough for orientation in looking for his food.

So we see that in rabbits the compensatory rotation corrects

the influence of the rotation of the head fully and it is probable that in mankind it is an atavism.

Concerning the highly interesting problem of the vestibular nystagmus I must be brief and will only speak about one point. You know there are many excitations which produce vestibular nystagmus. One of them is the irrigating of the ear with cold water, the so-called cold water nystagmus. Bartels holds that this is caused by suppression of the labyrinth by the cold, so that the same nystagmus is produced if one labyrinth were destroyed. Barany on the other hand thinks it is caused by a stream of endolymph in the semicircular canals brought about by local cooling of the labyrinth wall. This cools the lymph at that spot, consequently this fluid gets heavier and it flows off towards the lowest part of the semicircular canal. The lymph stream stimulates the sensory epithelium of the ampulla and causes in this way the nystagmus.

At first Magnus and de Kleyn attempted to determine whether paralysis of a nerve in the internal ear can be produced by cooling of the ear. Now de Kleyn has discovered that in cats the sympathetic nerve for the eye runs through the middle ear, and that irrigating the ear with cold water caused a palsy of this nerve, producing a narrow pupil, narrow eye slit, etc. Consequently, Bartels's explanation is plausible, but de Kleyn and Storm Van Leeuwen could not accept this view, because the nystagmus does not act in the same way as the nystagmus after labyrinth extirpation. Later those two experimenters proved that Barany's theory was right in the following way:

de Kleyn and Storm Van Leeuwen thought that if Bartels was right the nystagmus would be in the same direction in which the head is held. If, on the contrary, Barany is right, there will be an ampullipetal lymph stream when the ampulla is lower down, an ampullifugal stream when the ampulla is higher up than the cooled spot; no stream when the whole canal is horizontal, which means that the nystagmus must change abruptly in direction, when the cooled spot crosses the position in which it is on the level with the ampulla.

To examine this de Kleyn and Storm Van Leeuwen used our rotating operation board and irrigated one ear of a rabbit during the rotation with cold water; they noted the direction

of the nystagmus after every 10° rotation so that a rotation of 360° gave 37 notations. You see here the result which is corrected to show the influence of rotation on the change of action of the musc. rectus internus and externus. In no one of the three rotations does the head assume a position where the horizontal canal is really horizontal, but we can estimate where the nystagmus must change its direction and you see the result is very near what was previously estimated.

In this way it was proved that Barany's explanation is right. In the genesis of cold water nystagmus the cooling of the horizontal semicircular canal plays the principal part.

When we review the different functions of the vestibular organ we find: Tonic reflexes of the body and neck muscles; Stell-reflexes; tonic and clonic contraction of the eye muscles.

We always take it for granted that the tonic reflexes are caused by the otolith apparatus, the clonic by the semicircular canals, but until now this has not been proved experimentally. Whenever they tried to take away the otoliths the whole vestibular organ was spoiled and the same was the case when they tried to perforate and drain the semicircular canals only.

Now de Kleyn remembered that Wittmaak had published experiments in which he put guinea pigs in a centrifuge and revolved them about 2,000 rotations in a minute. The centrifugal power was so great that the otolith membranes were torn and pulled away from the maculæ. Magnus and de Kleyn made use of this. They examined a great number of guinea pigs with reference to every vestibular reflex, then narcotized them, put them in the centrifuge and revolved at the rate of 1000 rotations per minute for two minutes. As soon as the guinea pigs awakened from the narcosis they were again examined as to their vestibular reflexes and this examination was repeated every two days till no further change was noticed. Then the animals were given to the anatomist who examined the labyrinth in serial slides.

Magnus and de Kleyn had made the clinical diagnosis of what had happened in the labyrinth in which otoliths were torn and thrown away and the anatomist made the anatomical diagnosis. They knew nothing of each other's diagnosis till they compared them and in nearly every case the clinical diagnosis proved to be right.

I can show you here microphotographs of the normal otolith apparatus of the rabbit, of otolith membranes torn away, of otolith membranes which were partly torn away, of vestibular organs with large hemorrhages after the centrifuging; and after some experience nearly all diagnoses could be made clinically.

In this way for the first time it was proved what was the function of the otoliths and what of the semicircular canals. The otoliths are the organ for the reflexes of position; the semicircular canals for the reflexes of movement. There was only one surprising fact: The reflexes on progressive movements as lift movements, etc., proved to be caused by the semicircular canals, whereas Breuer had always said this to be absolutely impossible and every one had believed him. Magnus and de Kleyn had already offered an explanation for this fact, but it would take me too long to speak about this now. We cannot say with absolute certainty whether the explanation of the action of every particular otolith described by Magnus and de Kleyn is right, but we know these explanations to be probable, and the facts on which they are based to be true. Others try to explain the otolith action in another way, for instance, Quix, who explains that only the pressure of the otolith on its macula is the acting stimulus.

Mr. Chairman, Ladies and Gentlemen: In the first part of my address I reminded you of the manifold relations between the eye and ear which we may encounter in daily practice, in the second, I dealt with one of the most difficult problems of medical science and therefore I do not flatter myself that every one of you will have understood everything I tried to express, but I am certain I gave you something to think about. You saw that we are not at the end, that how after every solved problem new questions arise which await solution, but I hope you are convinced with me that we are on the right track and will by going on in this way come to know as much of the functions of the vestibular organ, as much of the relation between labyrinth and eye as is given to human beings to know.

THE INTRACAPSULAR EXPRESSION EXTRACTION OF CATARACT.

By Drs. A. S. and L. D. GREEN, San Francisco.

(With three illustrations in text and three on Text-Plates XV. and XVI.)

IN operating for the removal of senile cataracts, two distinct methods have been employed.

First—the capsulotomy method as introduced by Daviel and practiced, with but minor changes since then, by the majority of Ophthalmologists.

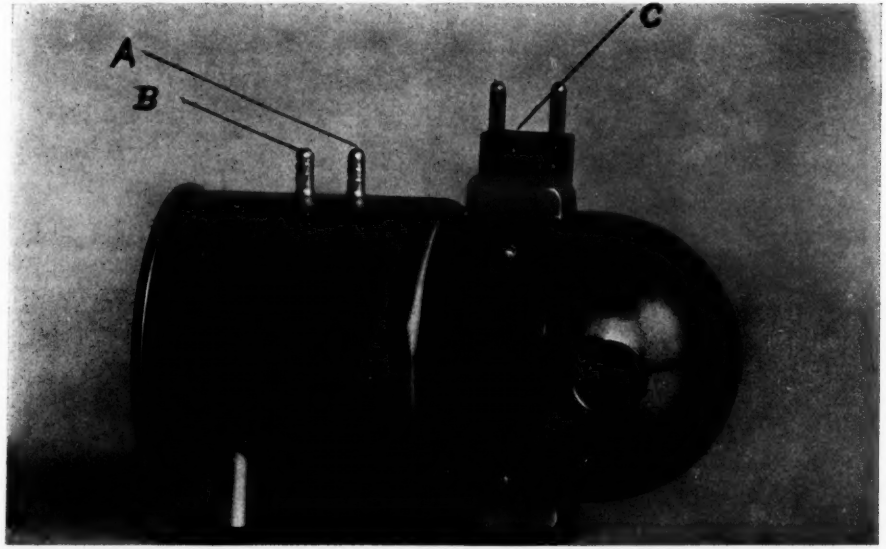
Second—the intracapsular method, the foremost exponent of which is Lt. Col. Henry Smith, and recently has been accentuated by Barraquer with a different technique.

The relative merits of the two procedures have, from time to time, been thoroughly discussed by the defenders of each, but it is pretty generally conceded that if a cataract could be removed within the capsule with as little trauma and danger to the eye as occurs when a capsulotomy is done, the former would be the operation of choice.

No one can honestly maintain that the capsulotomy operation is all that can be desired. Far from it. The waiting for maturity with its attendant economic disadvantages, the repeated needling in a large proportion of cases, the more frequent inflammations and the greater danger, though rare it is true, but real nevertheless, of losing both eyes from sympathetic ophthalmia, are conditions that do not apply in the same degree to the intracapsular operation. On the other hand, it must be admitted that greater skill is required to perform an intracapsular operation, otherwise the eye is subjected to unwarranted risk.

In a conversation with the late Col. Maynard he called our

ILLUSTRATING DR. A. S. AND L. D. GREEN'S ARTICLE ON "THE INTRACAPSULAR EXPRESSION EXTRACTION OF CATARACT."



Electric Motor Pump—Size $6\frac{3}{4} \times 3\frac{1}{4}$ inches.

A. Connects with tube leading to foot valve.

B. Air outlet.

C. Electrical connection.

ILLUSTRATING DRS. A. S. AND L. D. GREEN'S ARTICLE ON "THE INTRACAPSULAR EXPRESSION EXTRACTION OF CATARACT."

FIG. 4.—Conjunctival flap grasped with pressure forceps in the left hand, while the canula is being introduced with the right hand.

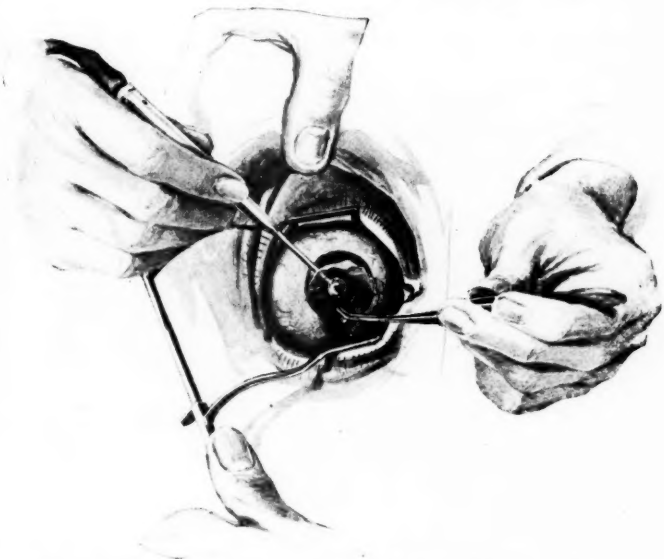


FIG. 5.—Pressing on the limbus with the ball of the forceps, as the cataract is being extracted.

attention to the fact that the term cataract extraction, as applied to the capsulotomy method, is a misnomer. It is really a cataract expression. The Smith-Indian operation is also an expression operation. On the other hand, the Hulen and Barraquer vacuum methods, as well as the Stanculeanu and Knapp forcep methods, are extractions.

In attempting to eliminate certain objections inherent in each of the above methods, we have finally evolved a technique for the intracapsular removal of cataract which combines both extraction and expression. From an experience with over one hundred cases we have found it the most satisfactory method that we have attempted. It reduces trauma to a minimum, and in the hands of capable operators, makes the intracapsular operation available in a large majority of senile cataracts.

In developing our method and instruments we have attempted to correct and improve upon the operative methods and instruments heretofore used, by studying the mechanical, physical, physiological, and anatomical principles concerned.

THEORY OF METHOD.

In order to better understand the reason for our technique it may be well to analyze the methods from which it was evolved, namely, the Smith-Indian method and the more recent vacuum operation.

While the object of the Barraquer operation, like that of the Smith operation, is the removal of the lens within the capsule, the effect upon the ocular contents is somewhat different. This is due to the difference in the mechanical principles involved; one depending largely upon expression of the crystaline lens while the other is dependent upon its extraction. In the Smith-Indian operation, pressure is applied at the limbus below, forcing the ocular contents upward and forward. By special manipulation the suspensory ligament is broken and the lens gently massaged into the wound, the cornea is gradually tucked under the lens, which is thus expelled.

As opposed to this, the principle upon which the Barraquer method depends, like its predecessors, the Hulen method described in 1910, and other similar methods, is the applica-

tion of a vacuum cup to the surface of the lens, suction holding the cataract while it is being removed from the eye. Barraquer lays great stress upon the vibrations transmitted by his pump, which he claims break the fibers of the zonula. In our experiments we have found that these vibrations occur in all motor pumps, but not in water pumps or vacuum bottles. The vibrations are caused either by the revolution or shuttle-like action of the mechanism as it exhausts the air, or by piston action in cylinders. But these vibrations apparently cease on the instant that the lumen of the tube or cup is closed. From our experience we are inclined to believe that these vibrations play little or no part in breaking the zonular fibers.

Unpleasant consequences, from a displacement of the intraocular contents, may follow either method, if too much force be used. If too great pressure is exerted by the Smith-Indian method, a drawn-up or hammock-shaped pupil may result. Or an expulsion of vitreous may occur, followed, although very rarely, by a choroidal hemorrhage. Too much traction on the lens and zonula, when using the vacuum method may disturb the tunics within the eye to such a degree that a detachment of the choroid or retina may follow. Or the capsule may rupture, in which event vitreous is apt to be sucked into the tube.

There thus appear certain factors in the two types of operation which are more or less objectionable and which we believe we have eliminated to a great extent, by our technique and apparatus.

We have attempted to reduce, to a minimum, the greatest danger from too much pressure, as in the Smith method, and too great traction of the suction method. This, we believe, we have accomplished by combining extraction with expression and as these forces act on the eye in a complementary manner, they tend, largely, to neutralize the trauma produced by each. To illustrate our point: If, for example, it would take 20*mm* of Hg to dislodge a certain weight from a receptacle by traction, then if 10*mm* of pressure were applied from underneath, it would reduce the lifting power required to 10*mm*. Or if 20*mm* of pressure alone were required to raise it, then if 10*mm* of traction were used, it would reduce the pressure to 10*mm*. In other words, the 20*mm* of pressure or traction when each is used alone would be reduced, if combined to 10*mm* each. This

principle we have applied to the removal of cataracts. Instead of using pressure alone, as by the Smith method, or traction alone as by the Hulen or Barraquer methods, we combine extraction with expression in the manner to be described, with the result that the disturbance to the intraocular contents is reduced to a minimum.

Before taking up the technique of the expression extraction intracapsular method, we will briefly consider some of the instruments heretofore employed and our reasons for modifying them or devising new ones.

VALVE AND CANULA.

There are certain mechanical inconveniences in the Barraquer apparatus, that interfere somewhat with the delicacy of manipulation. In his canula the vacuum system is opened or closed by pressing on the valve with the thumb. This must, of necessity, cause a cramped position of the hand, and all the time the vacuum is maintained, that pressure must be applied

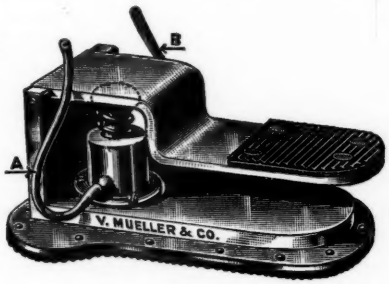


FIG. 1.—Floor valve.

until the cataract is extracted. This interferes with tactile and muscle sensibility of the hand, and in an operation as delicate as is required to extract a cataract, is certainly undesirable. Furthermore, the mechanism required for such a perfect valve as the Barraquer instrument possesses, makes the instrument heavier than it should be. The objection to the valve in the canula applies also to an opening in the canula, with the finger acting as a valve, as devised by McDannald.

It is of the utmost importance that the hand and fingers be absolutely free from restraint of any sort.

With these objections in mind, we have devised a floor valve (Fig. 1) to be controlled by the foot of the operator, thus eliminating the valve in the canula. We have incorporated an air vent in the valve, which permits the motor to idle, without the danger of drawing oil from the pump into the canula, as sometimes happens in the Barraquer apparatus. By transferring the valve from the canula to a foot valve, it permits the use of a very light canula, that is held in the fingers as delicately as a cataract knife (Fig. 2). We have made the cup round

FIG. 2.—Canula.

instead of oval so that a larger area of the lens surface will be grasped with less danger of rupturing the capsule. A circular cup will more easily adapt itself to various spherical surfaces than will an oval cup and will require less accuracy in application in order to have all parts of its circumference touch the lens. If a cross section be made of the cup it will be noticed that the edge resembles, somewhat, the half of a dumb-bell, giving a slight rounded depression inside of the cup immediately back of the edge. In other words, the diameter of the opening is a little less than the interior of the cup. When suction is applied, the lens and capsule will conform to this depression, giving a better hold on the cataract. This is important, as the indentation produced in the lens by this edge prevents the cup from sliding on the surface of the cataract after suction is produced. It is also important to eliminate all sharp edges from the cup as these may cause a rupture of the capsule.

PUMPS.

One of the most important factors in the vacuum operation is the manner in which the suction is produced. It is essential that the vacuum should be formed gradually and not too rapidly

to permit the lens and capsule to mold into the cup. A sudden vacuum, even of low degree, may rupture the capsule more easily than a high vacuum working more slowly. On the other hand, when a vacuum is formed too slowly, the operator is apt to attempt extraction before sufficient hold on the lens has taken place.

Various pumps have been used at different times, but it seems with little regard to their action. Not only must the vacuum be sufficient but the time in which a given pump will produce this, is important. In experimenting with various pumps we have found that water pumps, vacuum bottles, and similar devices are more or less objectionable because of the variability of the factors that produce their vacuum, so that the speed and force of the latter is not easily controlled. The speed with which a column of mercury rises will vary with the quantity of air it has to exhaust. The longer the tube and the larger the lumen the longer it will take to produce the vacuum; conversely, the shorter the tube or smaller the lumen the more rapidly the vacuum will be produced.

When the apparatus is completely assembled for operation, the canula, foot valve, and rubber tubing contain a larger amount of air to be exhausted than that at the pump and it will accordingly take a longer period of time to raise the column of mercury at the cup than at the pump itself. With the apparatus assembled for operation an efficient pump should raise a column of mercury to at least twenty-five inches in about ten seconds. The surgeon must familiarize himself with the length of time it will take to produce sufficient suction to hold the cataract. This can easily be done by making use of a finger cot filled with water to practice on.

To simplify the mechanism of the pump, and make it as near as possible fool proof, we have had one made to comply with the above requirements. It is very compact, raises a column of mercury to the desired height and by working in mercury instead of oil, it eliminates the necessity of the frequent inspection and filling with oil. After once filling the pump with mercury it requires very little attention. The construction of the pump is so simple that it does not require the delicate handling that one has to use with an oil pump.

PRESSURE FORCEPS.

For raising the conjunctiva flap and cornea to permit of the introduction of the canula, we have devised a pressure forceps which also takes the place of the Smith delivery hook (Fig. 3).

FIG. 3.—Pressure Forceps.

It does away with the handling of an extra instrument and thus diverting the surgeon's attention from the field of operation. This we have done by soldering a ball to the convex edge of one limb of a pair of light curved dressing forceps.

LID CONTROL.

For the control of the lids we prefer the eye speculum which we devised about eight years ago. With this speculum the lids can be held away from the eyeball and the danger from lid pressure greatly minimized, at the same time giving an unobstructed field of operation. It combines within itself in a large measure the relative safety of the lid hook with the greater exposure of the ordinary speculum. Care must be taken to so hold the speculum by steadying the hand holding it against the patient's cheek, that the blades will just miss the eyeball.

TYPES OF CASES SUITABLE FOR THE INTRACAPSULAR OPERATION.

As a general principle which must not be overlooked, only certain types of eyes are suitable for intracapsular operation. The facial characteristics of the patient give valuable information as to the results one may expect in a cataract operation. All things being equal, patients with cadaverous or deep set eyes, wide palpebral fissure and lax lids, afford the greatest safety. The more prominent the eyeball the greater the danger. A little reflection on the mechanics involved, will show the reason for this. In a deep set eye the lids and brow can exert very little direct pressure upon the globe, because of poor leverage. On the other hand the lids and brow possess a

great deal of leverage on protruding eyeballs. In addition to this, the recti muscles seem to exert great traction upon the globe, so that occasionally one may actually see the recession of the eyeball within the orbit, at some stage of the operation. All of this combines to increase the intraocular tension, so that when the eyeball is cut open there exists a far greater danger from expulsion of the intraocular contents than is the case in deep set eyes. In some of these cases of prominent eyes or tense lids, or where the palpebral fissure is narrow, we have found it of great advantage to do an external canthotomy immediately preceding the corneal section. With the method we employ to anæsthetize the lids it is a simple matter to do this and healing has occurred when the first dressing is done eight to ten days later. As far as possible, the intracapsular operation should be limited to senile cataracts. The older the patient the more easily will the suspensory ligament break and the lens be delivered. Congenital, juvenile, or traumatic cataracts, unless dislocated, should not be attempted by this method.

Among the many patients who present themselves to the ophthalmologist for relief, is that peculiar type of nervous individual whose lids twitch at the slightest provocation; the mere instillation of a drop into the eye or touching the lids with the finger, causes an involuntary spasm of the brow and lid muscles. These patients are apt to exert so great a pull on the globe with the recti muscles, that it may be difficult to steady the eye with the fixation forceps when making the section, and a tear in the conjunctiva may result. Such patients invariably exert great pressure on the speculum, and at any stage of the operation, from the incision to the completion of the toilet, are apt to expel vitreous. An important sign that frequently appears and serves as an indication as to whether or not to perform an intracapsular operation is the condition of the cornea upon completing the section. In the average case, the cornea resumes its normal contour, but when there is considerable negative pressure the cornea is apt to flatten out or even to partially collapse. This is the safest kind of an eye for an intracapsular operation. On the other hand, the wound may gape or there may be a horizontal furrow in the cornea, due to the intraocular contents being forced towards

the wound. Expulsion of vitreous is imminent in these cases and there should be no time lost in doing a capsulotomy and closing the eye without much toilet and without irrigating the anterior chamber. Here we might also mention that the patient is much more nervous and difficult to handle when operating on the second eye than when the first cataract was removed. Early in our experience with the suction operation, we found that we had to eliminate, in the majority of cases, the tumbler or Morgagnian cataracts from this procedure. Under this type must also be included the swollen lens, which is an early stage of the Morgagnian cataract, and is indicated by the very shallow anterior chamber and the pearly homogeneous appearance of the cataract. The capsules of these cataracts are so friable that the application of the cup of the canula to the surface of the lens almost invariably breaks the capsule. The effect is usually a partially dislocated lens, combined with a poor capsulotomy, with the lens matter, which is very difficult to remove, scattered about in the anterior part of the eye. Such cataracts should be removed by the Smith-Indian tumbler procedure, or a capsulotomy done and the lens matter thoroughly irrigated from the anterior chamber.

We find the above indications of considerable value and would suggest that the ophthalmologist, not familiar with the intracapsular operation, choose the safer types of case before attempting the more difficult ones.

The preparation of the patient is all important for a successful cataract operation. The patient must come to the operating table as fully composed as possible and during the operation must suffer little or no pain. It is probable that the pain produced during the iridectomy has caused as much disaster to eyes as anything in cataract surgery. But this danger can be practically avoided by partially paralyzing the lids and the elimination of pain by the deep orbital injection with novocaine.

PREPARATION AND TECHNIQUE OF OPERATION.

Having decided that the case is suitable for the intracapsular operation, the brow is shaved and lashes cut and the patient is assured a good night's rest with a sedative, the night

before. The following morning the lids are injected with two or three *cc* of a 2% novocaine solution, the external canthus being also injected to permit of a canthotomy if found necessary. One *cc* of the same solution is injected deep into the orbit, through the skin of the lower lid, immediately above the lower orbital margin. For this purpose a four *cm* needle is used and directed backward and slightly upward towards the optic foramen, so as not to strike the bony floor of the orbit. We have found this procedure of inestimable value, not only in controlling pain but also in helping to control the nervous movements of the eyeball and lid. Sufficient time must be given for the anæsthetic to act so that the injection is given while the patient is in his bed, forty-five minutes before operation. One drop of a 5% cocaine solution is dropped in the eye every five minutes for six or eight doses, the eye being kept closed between installations to prevent drying of the cornea. One drop of 1% atropine is also instilled to cause the pupil to dilate. The field of operation is sterilized with benzine, iodine, and alcohol and the conjunctiva flushed with 1-4000 bichloride solution. The vacuum apparatus is then tested by applying the cup to a finger cot filled with water, to see if the suction is in working order.

The speculum is inserted and a full half section of the cornea with a conjunctival flap is made and an iridectomy done.

The motor is turned on, the conjunctival flap is grasped with the pressure forceps in the left hand (Fig. 4) and the cornea raised while the canula, held in the right hand, is introduced and lightly placed upon the cataract. The valve is now engaged and a few seconds allowed for the spoon to become firmly attached to the anterior capsule, and the lens to mold itself within the cup. If this time is not given, the spoon will simply slide off, necessitating repeated attempts to hold the cataract. When satisfied that the lens is being firmly held, the left hand releases the conjunctiva and the pressure forceps which held it is shifted to the lower part of the eye, near the limbus (Fig. 5). The cup is raised so that the upper border of the cataract will be tilted forward into the wound at the same time drawing the cataract out of the eye. At the moment when the traction for the delivery of the lens starts, the delivery forceps is pressed gently on the lower part of the cornea, at the limbus, as in the

Smith operation, and followed up as the lens is being delivered. This tends to hold the vitreous back while forcing the lens out of the eye. We thus obtain an expression extraction with a division of the forces in each. The resultant trauma is not only less than that produced by the Smith or suction method, but also much less than that which frequently goes with the ordinary capsulotomy. The intraocular contents are disturbed to such a slight degree that little or no toilet is needed. The pillars of the coloboma seldom need replacing. All that is necessary is to smooth out the conjunctiva, put some mild antiseptic salve between the lids and the eye bandaged. This elimination of doing an extensive toilet is very desirable, as the sooner an operated eye can be closed the better. A hammock-shaped pupil seldom occurs nor does the iris become drawn up.

THE PRESENT STATUS OF VACCINE THERAPY IN EYE DISEASES WITH SPECIAL REFERENCE TO AUTOGENOUS VACCINES—REPORT OF CASES.

By Dr. L. HERBERT LANIER, Texarkana, Arkansas.

VACCINE therapy for various pathologic conditions of the eye presents a broad field for research and experimentation and one replete with possibilities. Its value has been proven by numerous investigators and I am convinced that vaccines should be more generally employed as a curative agent by Ophthalmologists everywhere and would be if the working theory of opsonic therapy were more generally understood and appreciated.

It has been found by experience that normal blood varies but little in opsonic strength, while in individuals who are infected the opsonic strength is materially lessened. The opsonic index is founded upon the ratio borne by the number of bacteria which become ingested by the leucocytes in infected individuals to that of the normal or healthy person. Reduced to percentage: If within a given time ten bacteria are ingested by the leucocytes in health while but five bacteria of similar type are ingested by one infected, the opsonic index of the one infected is 0.5.

The opsonic index is increased by injecting into the infected person dead cultures of the particular type of microörganisms (preferably from his own body) from which he is suffering. The earlier claims made by those who have experimented widely, notably Wright and Douglas, seem to be established, marking an epoch-making advance in therapeutics.

Phagocytosis has opened new therapeutic vistas and the

part played by infection in pathology has completely revolutionized our treatment. We know that antiseptic agents can not at all times be relied upon to combat the infective elements, especially in ophthalmic practice; hence our interest in any serum or vaccine which may neutralize microbic intoxication. The number of bacteria which can be ingested by the leucocytes depends upon their preparation by substances present in the plasma of the blood, known as opsonins. Opsonins are supposed to exert some influence upon bacteria by which they become prepared for ingestion by the leucocytes.

Of course, we do not at present possess a specific antitoxic serum to fight each infective malady. According to the law so well established by Pasteur the ideal method of treatment would be to oppose each infective disease with a specific serum; but certain vaccines do possess in addition to their purely specific action, therapeutic properties that may be utilized in other infections.

Paraspecific serotherapy:—Now if one is not prepared to accept paraspecific serotherapy as being worthy of trial in ocular infections then he must wait, perhaps too long, for a specific vaccine for each infective malady. It cannot be doubted that a specific serum such as that of diphtheria will have more chance of success in a diphtheritic infection, but, the same serum is sometimes found to be active against other infections, as the streptococci, staphylococci, meningococci, colon bacilli, etc.

An animal actively immunized against a toxin as potent as that of diphtheria or tetanus will have all the anatomic elements placed in a state of defense distributed each after its manner in the circulation; antitoxins, immunisins and antibodies. It is easy to conceive that the serum of such an animal will be rich in elements of defense of all sorts, and injected into an individual with an infective malady, no matter what the nature, will assist him to overcome the particular ailment.

In ocular affections it is not to be supposed that the practitioner will content himself with general, specific, or paraspecific treatment, neglecting local measures. Even if he should employ several measures without knowing exactly what has been the curative agent, it is better than to run the risk of a specific vaccine acting inadequately or too late.

In all nondiphtheritic infections of the eye a polyvalent vaccine may be injected as per indications. If improvement is not marked after three or four injections, during the interval there is time to cultivate the microörganisms present in the eye; for example, the staphylococcus, an autogenous vaccine is made and injected replacing the paraspecific treatment by active immunization with a sterilized culture of the staphylococci.

We shall outline those procedures which give most promise of permanency avoiding dogmatic statements. However, the advances in serum and bacterial therapy have been so rapid in the past few years that for one who has tested the potency of these remedial agents a tendency to be overenthusiastic is always noticeable, but if one were limited to a statement of the trend of scientific and clinical research, still a great deal of illuminating and valuable data may be presented which if given due consideration may lead to greater conquests in our battle against ocular disease.

Simon Flexner (2) is not very optimistic concerning the curative properties of "vaccines." He says, "Their main field of usefulness is protective, and although they induce active immunity, their effect is not enduring. The length to which this protective vaccination may be successfully and properly carried has not yet been determined. The outstanding success is typhoid para-typhoid vaccination, but other successes relate to cholera and possibly to the type pneumonias. The curative value of vaccines on the other hand, is a subject far less easily dealt with. The idea that vaccines can be used to combat generalized infections, because when injected under the skin they utilize the local tissues to elaborate healing immunity substances (antibodies) is a mere hypothesis that has never been verified. The lymphatic internal organs are the only ones known to be active in producing them and hence the inoculation of killed cultures or 'vaccines' in acute infections may merely amount to the adding, as it were, of fuel to the flames. And what in this respect is true of the bacterial bodies as a whole, as they exist in the vaccines, is true also of extracts or other preparations made from them."

Please note this significant statement by Flexner, which

while not contradicting his position as given above, yet is encouraging to those who believe in the efficiency of vaccine therapy: "Although an active antistaphylococcic serum has not been produced, still staphylococcus vaccine is therapeutically valuable in furunculosis, etc." Elsewhere in the same article he says, "Bacterial vaccines also have a limited therapeutic application in certain types of local infection, as furunculosis."

In a series of cases treated during 1920 and 1921, we have found in various infective eye diseases more favorable results after injections of stock vaccines or serum, both the specific and paraspecific products having been used rather extensively to which I shall refer again in this paper.

George H. Weaver has made some interesting observations concerning serum and vaccines and his preference for autogenous vaccines prompts me to quote him at length. He says: (3) "Streptococcus vaccines should always be autogenous. The importance of this is more apparent as the study of streptococci by more refined methods has shown that there are many strains of streptococci which differ among themselves in essential immunologic peculiarities. A vaccine prepared from one strain might be worthless against an infection by another one. There is nothing to say in favor of a polyvalent streptococcus vaccine supposed to be active against all types of streptococci. In multiplying the strains, the quantity of each becomes so reduced that the essential one, if present, is in such small amount as to be without therapeutic effect."

Streptococcus vaccines are contraindicated in acute and general infections. In these circumstances the body is already exerting all its powers to produce antibodies to counteract the infection. The addition of still more bacterial toxin results only in harm. In streptococcus septicemias vaccines are useless. In subacute and chronic local streptococcus infections, autogenous vaccines, given subcutaneously, sometimes act very favorably. This is especially true of infections of mucous surfaces unassociated with accumulations in poorly draining cavities. The initial quantity should be small (from ten to twenty million) and in subsequent injections the amount should be gradually increased. Moderate local reaction is desirable, but general symptoms usually indicate that the

dose given has been too large. The reaction from one injection should subside completely before another is given.

The experience of ophthalmologists who have given vaccines and sera a thorough trial quite often conforms to the views expressed by May as follows: (4) "Vaccines and sera are valuable agents in suitable cases of ocular disease. When possible, an autogenous vaccine should be made. When this is impracticable, stock preparations may be used. Gonococcal vaccine gives excellent results in gonorrheal iritis. Less certain effects in purulent conjunctivitis, staphylococcal vaccine may be of service in obstinate examples of phlyctenular affections. Autogenous vaccines sometimes initiate a rapid cure of ulcers of the cornea and hordeola and are occasionally useful in dacryocystitis and post-operative infections. Antitoxins are indispensable in diphtheritic conjunctivitis. An antipneumococcus serum may be of service in the early stages of infected corneal ulcer. Tuberculin is very extensively used in tuberculous eye affections, often with brilliant results."

I have given much study, experimentation, and clinical employment to vaccine therapy in ophthalmic practice and the time-honored measures of proved worth have never been wholly abolished in treating the various diseases, except in a limited number of cases. I have considered bacterial therapy as a valuable accessory in treatment. It was never intended to be, nor will it ever be a cure-all. Nevertheless, in certain classes of cases the results have been consistently so striking that the value of inoculation by dead bacteria is undeniable.

Autogenous bacterins are always to be preferred to the stock preparations, and success or failure frequently depends on this fact. Although the duration of the period of greatest potency of bacterins is undetermined, the best results have been obtained when the pus has been recultured and a fresh bacterin prepared every two to four weeks.

Thomas arrives at the following conclusions as a result of three years of experience in bacterial immunization (5). "It is believed that the best effects therapeutically, particularly in chronic cases, occur when the quantity is slowly and cautiously increased, thereby, as has been thoroughly demonstrated in tuberculin therapy, avoiding hypersusceptibility or anaphylaxis."

Sherman's observations are interesting. He says: "Immunity assumes two forms, local and systemic. A local immunity is manifested by the development of a local resistance to certain infecting organisms while other parts of the body, composed of the same variety of tissue, are still susceptible to the infection. This is well illustrated in a case of erysipelas. Here the inflammation subsides (8) first where the infection started, but continues to extend into new territory until it finally dies out." This shows that during the infection a localized immunity does not influence the surrounding tissue sufficiently to prevent its extension until sufficient antibody has been absorbed from the tissues in the affected area to develop a systemic immunity, when the infection can no longer extend. It may be aroused when attacked by invading organisms for self-protection. In addition to this localized tissue resistance antibodies formed in any part of the body may, by means of the circulating medium, be conveyed to all parts of the body and render the entire body immune.

In the treatment of eye infections with vaccines, the question naturally arises whether immunizing substances which are developed in other parts of the body can be conveyed by means of the blood to the nonvascular structures of the eye, as cornea, lens, vitreous, etc. To answer this question, Morax and Soiseau (6) made some investigations with animals immunized to diphtheria and tetanus. They found that the aqueous in healthy, highly immunized animals contained proportionately less antitoxin than the blood serum of the same animal, but on retapping they found the antitoxin content of the aqueous very much increased. This shows that the increased blood supply incidental to the traumatism caused by withdrawing the fluid from the interior of the eye enlarged the channels enough to allow free access of the antibody in the blood to the nonvascular structures of the eye. Irritation due to an infection will similarly increase the supply of the immunizing substances contained in the blood to the nonvascular structures of the eye. From this it would seem advisable to apply immunotherapy in infections which involve the nonvascular structures of the eye. When infecting organisms gain lodgment in the tissues where immunizing substances are not readily available, the infections are liable to

become destructive in character. This applies with unusual significance to the eye, in view of the importance of the organ and the amount of serious permanent damage that may follow even a small amount of tissue destruction. It does not require much of a central corneal ulcer to permanently impair vision. Let us take for example a corneal ulcer due to the streptococcus or pneumococcus, in a case where the immunizing resistance to these organisms is comparatively low. A corneal ulcer is necessarily too small a lesion to arouse a systemic reaction enough for sufficient production of antibodies that an adequate amount of them will find their way to the eye and destroy the infecting organism before irreparable damage is done, but by injecting a bacterial vaccine under the skin a very large amount of tissue, as compared with that involved in the corneal infection, is actively called into service for antibody production. This antibody is then conveyed by means of the circulatory system to the infected cornea and aids in destroying the germs long before it would have been possible for the infection in the cornea to stimulate an equal amount of antibody production. What is true of corneal infections applies equally to infections of other nonvascular structures of the eye.

In eye infections it is always advisable to make a bacterial examination because infecting organisms may be present that have a distinct tendency toward chronic infections when a corresponding stock vaccine or an autogenous vaccine should be employed.

Teulieres (7) has used antidiphtheritic serum in eye affections of an infective nature, especially in hypopion keratitis. He found that it was a curative agent; often, however, only a useful adjuvant to the usual methods employed in these conditions. It should be used subcutaneously and as soon after infection as possible. It may be employed as a prophylactic measure. His results show that it ameliorates the pain, checks the progress of the infection, and favors the absorption of the infiltrate and exudate and the formation of new tissue.

Zimmerman (8) has employed Behring's diphtheria serum in a series of cases of inflammatory and traumatic conditions of the eye. When the initial dose is 1500 units, he finds that in many cases only one injection is required to bring about a

cure. If 1000 units were first used the results were less favorable and a repetition of the dose did not have nearly the effect of a large initial dose. If early beneficial effect is not noted, no further improvement will result from repeated injections. In no instance was any complication noted, no skin exanthemata nor any subjective disturbance. He says that while there were some cases in which a combined local and serum therapy was employed he is convinced that eyes were thus saved that would have been lost notwithstanding energetic surgical treatment alone. The list contains cases of infected corneal ulcer, post-operative infection and severe iridocyclitis, traumatic cataract, gonorrheal iritis, orbital cellulitis, two large septic ulcers of the cornea and a purulent dacryocystitis.

George S. Derby (9) gives an exhaustive review of vaccine and serum therapy in ocular tuberculosis. He believes that beneficial results may be obtained with all the standard preparations. On general principles, however, the filtrates or solutions, such as Koch's old tuberculin T. O. and those of Deny's B. F. and Beraneck's T. B. K. are safer for the beginner, more uniform in their dosage, and less likely to cause noticeable reaction than are the emulsions of vaccines T. F. and B. E.

Derby records 30 cases of ocular tuberculosis treated by tuberculin, 15 of sclerokeratitis, 9 of interstitial keratitis, and 6 of kerato-iritis. On the whole results are favorable although in a number of cases it is by no means certain that a cure would not have taken place as speedily without the tuberculin treatment. The results in treating cases of extrinsic tuberculosis are very encouraging but internal tuberculosis of the eye has not responded so favorably to tuberculin treatment except in the iris where the blood and lymph supply is good. With regard to dosage, it is necessary to give larger doses of vaccine in diseases of the eye than in treating disease elsewhere because the blood and lymph flow being limited, a less amount of opsonin will be brought in contact with the diseased area and also the risk of toxic effect is less as the area of infection is small.

Elsewhere in this paper the writer has stated that in all diseases of the eye due to pyogenic organisms it is advisable to use a specific vaccine from cultures of the infecting organism obtained from the patient to be treated, but this is generally

unnecessary in staphylococcus infection in which a mixed vaccine prepared from cultures of staphylococcus aureus and albus is usually efficient. In the internal infections of the eye the bacteriological diagnosis is difficult. However in cases of iridocyclitis, cultures may be made from the aqueous after paracentesis and the vaccines prepared from these have been used with excellent results.

CASE 1.—I. W. G., age 21, American, married, general health good except specific urethritis and gonorrheal conjunctivitis. Came to me after treatment for two days by another oculist. Pus flow profuse, corneal ulceration both eyes. Evidently a specific infection had not been suspected as he was using a simple eye lotion. The eye was irrigated with 1–5000 bichloride solution; then with sterile water and nitrate of silver—a few drops of 1 per cent. solution—brushed over the everted lids; then a 25 per cent. solution argyrol was ordered applied by means of an eye bath every three hours, lids widely opened by the fingers in such a way as to fill the conjunctival sac. The next morning corneal ulceration worse and pus flow increased—discouraging. Sherman's No. 49 gonococcus and combined vaccine 0.5*cc* was given and as the therapeutic response was satisfactory, in fact remarkable, 1*cc* was given each day for six days and after this 1*cc* every fourth day for two weeks by which time the corneal ulcer has entirely healed. Now the local treatment first referred to was continued during the vaccine treatment, but the vaccines evidently influenced the favorable turn in the disease. The corneal scars are large and central but proper iridectomies will give fair vision.

CASE 2.—W. A. P., age 20, American, weight 104 pounds, poorly nourished, anæmic, came to me December 2, 1920. Had been treated for ten years at intervals by other oculists for diseases of the Meibomian glands and multiple recurrent chalazion and had never been entirely well at any time. I gave her at once staphylococcus combined vaccines, Sherman's No. 22, 0.5 mil. every third day alternated with 7½ gr. of cacodylate of sodium injections, extirpated the chalazions present and recovery was complete after one dozen injections of each and she has remained free from any disease of the lids until the present time.

CASE 3.—T. H. W., age 66, general health fair, family history good, had mature cataract both eyes. The post iritic adhesions in right eye made left seem more favorable for good operative results except that he had a pronounced

ectropion with severe blepharitis with a chronic discharge. Smears and cultures showed staphylococcus aureus and a few pneumococci. Two hundred million staphylococci and 100 million pneumococci in stock vaccine caused marked improvement in twenty-four hours. A few days later an autogenous vaccine with increased dosage was given and repeated every four days. In twenty days my patient had no discharge and the cataract operation was done on this eye with primary healing and a good visual result.

Before any operation for cataract where the conjunctiva is rich with bacteria, I give repeated preliminary injections of autogenous vaccines prepared from the flora of the patient's conjunctival sac. I have on two occasions treated wound infections after cataract operations with beginning hypopion, smears and cultures indicating the stock vaccine to use, until the autogenous vaccine was ready and in each instance the staphylococcus aureus and albus was the offender and perfect recovery followed vaccine treatment.

I have 11 cases selected from my case records for report but the time allowed me forces a collective review of them as follows: The practice was to administer an initial dose of mixed catarrhal vaccine when the patient was first seen, employing an autogenous vaccine where this was possible as soon as prepared, otherwise stock vaccine was used.

There were three cases of corneal ulceration, two due to the staphylococcus and one due to pneumococcus. Results as regards vision excellent except in the pneumococcus infected one in which the scar left made iridectomy necessary. There were three cases of perforating injury of the cornea with wound infection and hypopion. Two recovered, both due to staphylococcus; and in the one case due to the pneumococcus infection although the infection yielded the end result was not so good. There were two cases of ulcerative keratitis with hypopion both of which were cured as to infection but results optically in one not good. In the one cured vaccine with repeated paracentesis was done. One case of mucopurulent conjunctivitis of seven years' duration, due to staphylococcus aureus in which local treatment had failed, yielded promptly to the vaccine treatment. Two cases of gonorrheal iritis diagnosed by exclusion; both improved after the first injection and recovered satisfactorily.

In all these cases improvement was noticed within twenty-four hours after the first inoculation. The minimum number of treatments in this group was five; the maximum number fifteen. The duration of treatment was from one to eight weeks. The injection was repeated from twelve to twenty-four hours to two or three days, the interval varying according to the indications.

Affections of the conjunctiva get well so readily by means of ordinary remedies, as a rule, that I have used vaccines for their cure rather infrequently, although I expect soon to try vaccines and serum therapy in trachoma and vernal conjunctivitis.

In conclusion I repeat that in an infection of the eye, acute or chronic, it is of great importance to act quickly before irremediable damage has been produced. To strengthen the vital resistance of all the tissues should be our aim. The elements of defense may be found in stock or autogenous vaccines or in the normal serum of animals, or, better still, in activated serum. I believe they are worthy of trial in all eye infections.

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A TENDON TUCKER AND METHOD OF SUTURING.

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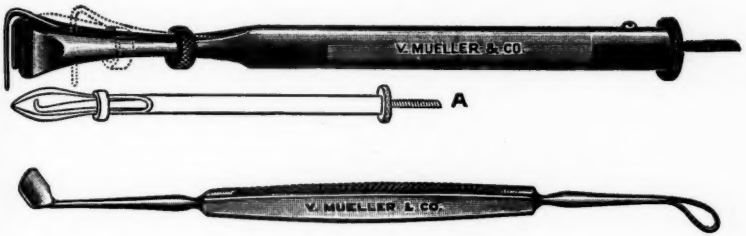
(With eight illustrations in the text.)

AFTER considerable experimenting and the construction of numerous models, to overcome the practical objections met with in experience with tuckers now in use, an instrument has finally been designed and tried out in a sufficient number of instances to recommend it to the profession. This instrument is light and easy of manipulation, designed to be used in a position at right angles to the tendon, thus affording a free field of operation. By its use, one secures a uniform shortening of any desired degree, and the tuck or fold in the tendon and muscle can be securely clamped at its base while the sutures are being placed in an exact and effective manner. It permits one, approximately at least, to measure the amount of shortening obtained. The likelihood of producing any change in the plane of rotation of the globe is minimized and the instrument can be immediately released without lateral traction on the tuck, thereby avoiding undesirable strain on the sutures.

The instrument is constructed with two parallel solid blades, between which a right angled tendon hook is raised by means of a milled nut at the top of the handle. The handle is made oval to facilitate easy manipulation, and the tendon hook is provided with a graduated scale at its upper end which approximately measures the number of degrees of shortening obtained. This scale does not follow the rule of one millimeter of shortening for each five degrees of correction, but is based upon clinical results following tucking operation, without

tenotomy, and with due consideration to the unavoidable muscle stretching which usually occurs.[1] The edges of the blades are slightly rounded to facilitate easy movement of the tendon over the blade end and to prevent undue tendon



stretching. A ring clamp slides over and secures the closed blades after obtaining the desired amount of tuck, and prevents any slipping of the tuck during suturing.

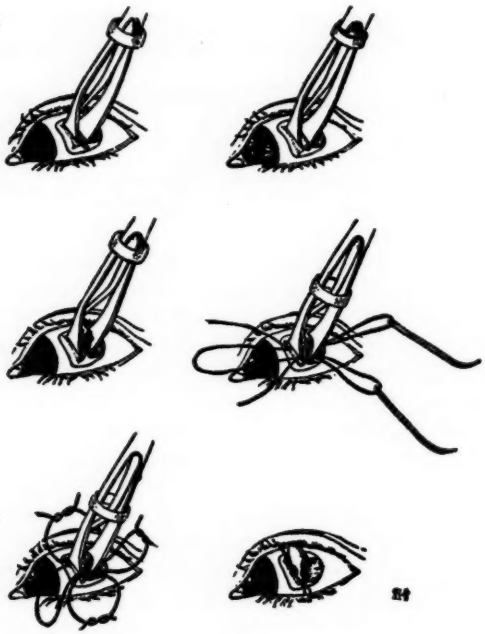
The technic employed is as follows.

After preliminary cocainization a subconjunctival injection of two or three minims of 2% cocaine adrenaline solution is made well back along the muscle sheath beneath the canthus. Through a liberal vertical conjunctival incision over the tendon insertion, the overlying conjunctiva is freed in all directions, the muscle fully exposed and its lateral borders defined with division of any scleral adhesions, exactly as done in preparation for the Reese resection, without, of course, cutting the tendon near its insertion. The hook of the instrument extended beyond the open blades, is inserted beneath the tendon from two to six millimeters from its scleral insertion, depending upon the amount of shortening to be obtained. Moistening the tips of the blades with glycerine materially eases the strain on the tendon in passing over the blade ends, and prevents, in some measure, undue stretching of the muscle. The milled ring at the top of the handle is rotated until the tendon is drawn up between the blades to the desired amount, the

[1] It will require a very considerable series of cases, observed over a long period, to determine the probable modification of this scale to render it more accurate. It is hoped that others may contribute their results to make it still more exact.

blades are clamped, and the ring clamp gently pressed downward until secure.

An important feature of any tucking operation is that sutures should be so placed that not only the central tendon



fibers but also the border fibers are equally sutured. The entire breadth of the tendon and muscle should be evenly sutured to prevent puckering, and sutures must hold for a sufficient time to insure complete permanent adhesions. The method found most effective and easily done, and which meets all necessary requirements, is as follows:

A 28-inch strand of "00," 40 day catgut is double-threaded with half curved round needles one inch in length, each needle being placed about ten inches from the ends of the ligature. Each needle is then passed through the base of the tuck beneath the closed blades of the tucker from the corneal side, where the

middle and outer thirds of the tendon join. Any inclusion of conjunctiva is carefully avoided. The needles are drawn through and cut off, thus producing three sutures from one. The central and wing sutures are tied and double knotted. The ring clamp is released, a reverse turn of the milled nut given to slightly release the tendon hook, and the instrument is removed. The conjunctiva is closed with number one silk sutures.

In heterophoria and in squints of small amount, tenotomy, as a rule, has not been done until later. In higher degrees of divergent strabismus, division of the externus is advisable at the time. In practical use, it has been found that exophoria of six degrees was easily corrected by taking the least amount of tuck possible with the instrument. On the other hand, convergent strabismus of forty degrees was fully corrected by tucking as fully as possible, combined with tenotomy of the internus at the same sitting.

It has been found that the use of what I choose to term the Gifford "Splint" suture, a heavy silk suture passed completely beneath the opposing unoperated muscle and through each lid about four or five millimeters from its margin, is a most effective method of immobilizing the eye for from four to six days, and obviates the necessity of occlusion of both eyes to prevent ocular movement and undue strain on sutures. It has been repeatedly used and upon either lateral muscle without damage to the cornea in any instance. I regard it as a most valuable adjunct to any muscle shortening operation.

A thorough preliminary study of the muscle measurements and the dynamic forces involved, combined with a fairly considerable amount of actual experience and judgment, is required to satisfactorily correct every muscular defect. A certain amount of final readjustment of controlling innervating forces must occur after every operative correction, especially when good fusion exists, but it is surely easier of accomplishment, in my experience, after tucking operations than by any other method of operation. With the instrument described, used in conjunction with the method of suturing recommended, the tucking operation is much simplified, the parts are securely held in apposition during operation and during healing, the operative result is as nearly the end result as it is possible to

make it, and, in my hands, there have been no complications in healing. The fold or hump formed by tucking is only temporarily objectionable, and has never been sufficiently so to prove an argument against this procedure. However, it is well to inform the patient of this feature in advance of operation.

This instrument is manufactured by V. Mueller and Company of Chicago, to whom I am indebted for making the models for me.

EVISCERO-NEUROTOMY WITH AN ENDOTHESIS AS A SUBSTITUTE FOR ENUCLEATION.

By Dr. T. J. DIMITRY, New Orleans.

(With seven illustrations in the text.)

I HAVE expressed at times in different communications (2) a dissatisfaction with the results obtained following enucleation. I have also condemned the usual evisceration (3) as a substitute for enucleation because it leaves a dead space or a blood clot. Enucleation at times will serve its purpose but it is limited in its scope.

Like many of my confrères I have been ambitious for an operation which would correct faulty features noted following enucleation, evisceration, and substitutes. In this article I am submitting a new technic which I designate "Evisceroneurotomy" with an endothesis.

ESSENTIALS.

The first consideration in estimating the value of any new operation is that it shall protect the other eye from a possible sympathetic ophthalmia, and the selected procedure should guard the other eye to the same extent as does enucleation. The second consideration is to obtain results which are most satisfying, surgically and æsthetically, for the patient and surgeon. The ideal operation reproduces the companion eye as to position, color, and motility. The first essential has been considered in a previous communication (3) while the latter is the theme of this paper.

THE BED.

So far without a single exception none of the substitutes have given full or general satisfaction as regards motility or position. I acknowledge that many of the substitutes provide a more natural bed for the prothesis, but the motility is usually not greater than is obtained after a carefully and well performed enucleation. It must be admitted, however, that this more natural bed results in better drainage and position for the lids, which is greatly to be desired and justifies to a limited extent many of the suggested operations.

THE MOTILITY.

Any technic which disturbs the conjunctival cul-de-sacs, reduces the radius of motility for the prothesis and is a faulty feature to be noted in practically all of the substitutes. The reason why the prothesis moves is not generally appreciated for many labor under the false impression that it becomes actually a part of the retained globe. This is not the case and the motility is dependent to a great extent upon the conjunctival cul-de-sacs themselves, pushing the prothesis with the globe, as the globe itself moves in different directions. Hence it is that we can explain both the movement and the limited excursion of the prothesis. If the prothesis was a very thin shell which covered only a little more than the cornea and not the cul-de-sacs a greater radius of motion would be obtainable. The prothesis is, however, a model of the conjunctival cul-de-sacs while it should be a model of the eye alone and limited to the bulb exclusive of the sacs.

ANÆSTHETIC.

The procedure is usually performed under local anæsthesia, for there is instillation of the selected anæsthetic which is usually a four per cent. solution of cocaine and, if necessary, infiltration of novocaine around the eye. General anæsthesia is used for children, rebellious patients, and when dealing with painful eyes.

THE INCISION.

The incision is seldom selected as it is governed by the condition demanding the operation, though the incision of choice would be in the sclera, concentric with the limbus four or five *mm* behind and about one fourth of the circumference of the

DIAGRAM 1.—Incision of election.

cornea. At either end this incision is continued backwards, tangential, either between the muscle fibers or between any two muscles. The length may extend to the optic nerve, though this is seldom necessary.

Evisceration.—The contents of the eye are then carefully eviscerated, and a gauze wrapped probe more readily removes the uveal tissue than does picking it with forceps. There is no

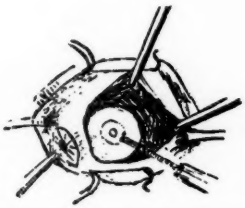
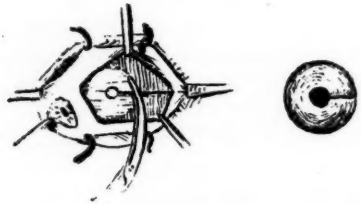


DIAGRAM 2.—Eviscerating and providing posterior window.

necessity of removing the endothelial layer from the posterior surface of the cornea, but it should be permitted to remain if possible.

Posterior Window.—This window is made very much as previously described (2) except that a knife is used instead of the knife and scissors. The nerve is severed with the knife. In making the window the incision which extends backwards to the nerve may be used to advantage. Through it the

nerve may be cut, a section of the sclera removed, and the window formed when suturing.



DIAGRAMS 3 and 4.—Another method of providing posterior window. The horizontal incision of No. 4 is carried to the optic nerve, the nerve is then severed with a small area of sclera. The window is formed when suturing. This is the better incision when it is desired to make a heterogeneous graft.

Suture.—The endothesis is inserted and the wound is closed by inserting sutures placed close together. Sharp cutting needles as also the use of the Fox's suture forceps prevents unnecessary trauma. The reaction following the operation is seldom severe and the sutures are removed in six to nine days.

COMMENTS.

Local anæsthesia is suggested advisedly and is thoroughly efficient for it is seldom necessary to resort to general anæsthesia except as previously noted. The operator simply eviscerates and the cornea is not removed. It is retained even though it is ruptured, for the wound in it may be enlarged and thus utilized. In such cases on completing the operation the cornea is sutured and here we may use to an advantage the little gold plates which have been recently suggested for suturing the cornea. If the globe is ruptured then the site of rupture is selected for the point of entrance.

ENDOTHESIS.

The sphere which is placed within the sclera is usually of glass or gold and about 14–17*mm* in diameter. It is neces-

sary to have a number of different globes for the ball should be neither too large nor to small. I desire to submit a prelimi-

DIAGRAM 5.—Endothesis in gold with enamel iris and pupil. The same can be blown in glass. Has button.

nary report on the endothesis which I am now developing and I would welcome your assistance in having it produced at a

DIAGRAM 6.—A different designed endothesis. Without button.

more reasonable price, giving an opportunity for more general use. The drawing depicts the endothesis, which is of gold and

DIAGRAM 7.—Section of the gold endothesis with enamel iris and pupil.

enamel, though I hope in the future to report its development in glass. The small button noted posteriorly is intended to fit in the posterior window without closing it. This button retains the endothesis in a proper position. At the opposite pole is the iris and pupil, the center of which is misplaced about fifteen degrees.

ORIGIN.

The operation which I have described embraces the suggestions of different authors. The evisceration feature of the

technic is credited to Barton (4) and Noyes (5) for they were the first to advocate the removal of the scleral contents. The severing of the optic nerve from the globe is credited to Boucheron (6) for he made such recommendations at the time that Deutchmann's theory held forth as to the mode of propogation of sympathetic ophthalmia. The posterior section of the sclera with the optic nerve attached is credited to Hall (7) and Huizinga (8). At least partial credit for retaining the cornea belongs to Gifford (9) and the incision in the sclera to Poulard (10). As in the Mule technic a ball is implanted. Even the title of my operation, "Eviscero-neurotomy" is an adoption from Huizinga.

The only features in the operation which are truly original are: the type of endothesis; the manner of preservation and the consequent advantages of the transparent cornea; and the development of a composite operation from a heterogeneous mass of suggestions.

RESULTS.

The hollow glass or gold ball produces a reflection which is seen through the transparent cornea. This wonderful advantage of transparency is lost sight of in the many substitute operations. Even if the cornea did not remain transparent as it actually does, at least it must be admitted that the corneal tissue does remain alive, though opaque. In this event, therefore, still tremendous advantage is obtained in that the prothesis can be placed on a natural bed, which is ostensibly a whole eye. Furthermore, the cul-de-sacs are left undisturbed and a properly adjusted thin glass, fitting only the bulb and not the cul-de-sacs, will result in a most satisfactory range of motility.

It would be most gratifying to me if other investigators could be stimulated in an attempt to duplicate my experience in demonstrating the persistence of corneal transparency in spite of evisceration. My personal experience at present is too limited to be able to state that my observations will prove uniformly the same, yet working jointly with other investigators an irrefutable mass of material might be readily accumulated and result in exceedingly valuable information.

To obtain uniform maximum results all investigators should keep the same essentials in mind: (1) Retain the cornea. (2) Provide the posterior window. (3) Implant the spherical ball of plain glass, colored glass, or gold. (4) Note the changes that occur in the cornea. (5) Note the character of bed obtained for the prothesis. (6) With these points kept in mind in preliminary observations, then insert in subsequent operations when it is generally procurable from the manufacturer, the Dimitry endothesis.

Should voluminous investigation along these lines corroborate my own limited experience, then we have obtained a result, procuring for the patient, for all intent and purposes, a duplicate functioning eye in every respect, ideal, except as to sight.

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CAUSES OF BLINDNESS AMONG FILIPINOS AS OBSERVED IN THE PHILLIPPINE GENERAL HOSPITAL DISPENSARY—A PRELIMINARY REPORT.

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IN our efforts as physicians to teach the masses to observe the important rules of hygiene for safeguarding the public health from epidemics, we should not for a moment forget to inculcate also in their minds the need of taking good care of this very delicate organ—the eye. Each one of us is cognizant of the sad fact that many cases of permanent blindness among our laity could have been prevented had the proper care and treatment been early instituted. We also know that a blind person is an economical loss to the country.

But before we proceed to start a campaign for preventing blindness, we should first determine its most common causes. The Philippine General Hospital Dispensary, where one meets thousands of eye cases, offers the best place at present for an investigation of this nature.

Now, having these materials and the facilities for diagnosis, the next thing we have to think of is an arbitrary definition of blindness. Blindness, in the strict sense of the word, is the inability to distinguish light from darkness. But this definition is too exclusive. There are many who can perceive light and yet are too blind to do the ordinary activities of life. According to the last annual report of the Bureau of Health there are about 4276 blind in the Philippine Islands. I am

quite sure that this number will be greater if we do not use the strict meaning of blindness. Our country is rapidly progressing along social lines. In the near future we will see social workers organizing themselves to look after the education, employment, and maintenance of these unfortunate blind. Hence, we need to have more or less accurate number of our blind countrymen. And to accomplish this I would suggest to future investigators to adopt a uniform definition of blindness. Bishop Harman (1) in his criticism of the British Census of 1911 very truly said that many partially blind or blind for all practical purposes were never enumerated at all so that the results were very misleading. In this preliminary investigation, I have followed the definition of blindness adopted at the Egyptian Ophthalmic Hospitals, namely, "inability to count fingers held up at a distance of one meter from the patient." This is simple and very practical.

These statistical tables are based upon 700 cases of blindness in one or both eyes examined during the years 1920 and 1921.

TABLE I.

Congenital blindness	6
Acquired "	694

TABLE II.

Blind in one eye	440
Blind in both eyes	260

TABLE III.

Children (1–13 years inclusive)	123
Adults (14–60 " ")	461
Old (61–up)	116

TABLE IV.

Number of eye patients during the years 1920 and 1921	5,604
Number of patients blind in one or both eyes	700

TABLE V. *Causes of Blindness:*

Cataract	187
Injury with subsequent infection	173
Glaucoma	64
Complication of some fevers	37
Keratomalacia	31
Syphilitic infection	13
Gonorrheal infection	12
Trachoma	8

Scleritis (deep form)	6
New growths	4
Tuberculosis conjunctiva	2
Hysterical blindness	1
Microphthalmus	5
With obscure history and origin	161

DISCUSSION.

Table I. We have observed 2 cases of congenital cataract, 1 case of microphthalmus, 3 of "prenatal corneal scarring."

Tables II, III, IV are self-explanatory.

Table V. Causes of Blindness:

Cataract.—There were observed 170 cases of senile, 15 of juvenile, and 2 of congenital. Traumatic cataract is included under *Injury*.

Injury with Subsequent Infection.—These injuries have caused the following eye affections: Corneal ulcerations, 60; Leucoma, 28; Traumatic cataract, 27; Panophthalmitis, 15; Phthisis bulbi, 13; Staphyloma, 10; Iridocyclitis, 2; Rupture of the eye from gun shot, 1; Rupture of the eyeball from other trauma, 2.

We have 15 cases of blindness as complication of dacryocystitis. I wish to emphasize here the fact that a great majority of corneal ulcerations as those produced by foreign bodies would not have caused this disastrous result—permanent blindness—had not the eyes been subjected to further trauma and the subsequent infection caused by "kahig." ("Kahig" is the procedure employed by the laity to remove foreign bodies in the eye usually by means of the tender end of the stalk of a certain grass, without the least aseptic precaution.)

Glaucoma.—The majority of cases have history of acute symptoms and vision is rapidly annihilated.

Complications of Some Fevers.—We have 23 cases of blindness as complication of variola. I am convinced that this number is much less than what we would find were we to look for this kind of blindness in the provinces, for the reason that the totally blind do not often seek relief. They or their friends are convinced of the hopeless nature of the calamity which has befallen them and they do not come to the clinic. We have observed 6 cases as complication of measles, and 8 of other fevers.

Keratomalacia.—This is observed among children of poor families. They are very poorly nourished and with history of protracted ileocolitis or tuberculous pneumonia.

Venereal Disease.—Our cases of purulent conjunctivitis would have been much more were it not for the effective campaign of the Bureau of Health, the Public Welfare Commission, and the Philippine General Hospital. We ought to feel proud when we hear that in Mexico (2) the most common cause of blindness is ophthalmia neonatorum. In round numbers it is 30%. In British Blind Schools (3), ophthalmia neonatorum is the cause of at least ⅓ of the blindness, and it accounts for upwards of 10% of all cases in England.

With the increase of cases of syphilis, blindness from this disease is gradually increasing.

Trachoma.—Blindness from this disease is apparently uncommon. For the sake of comparison, we can mention that 25% of all the cases of incurable blindness in Russia are due to trachoma (4).

New Growths.—We had 2 cases of glioma retinæ, 1 of epithelioma, and 1 of papilloma of the choroid.

Tuberculosis.—Since tuberculosis is the most prevalent disease here, we should be on the lookout for the ocular involvement of this disease. We had 2 cases of tuberculosis of the conjunctiva.

Blindness with Obscure History and Origin.—We cannot get good history from these cases. Patients cannot trace the origin of the trouble. Oftentimes, they attribute the inflammation of the eye and the subsequent blindness to sleeping with the hair wet. These cases are grouped under the following affections: Leucomas, 34; Plastic iritis, 29; Corneal ulcerations, 27; Keratitis, non-suppurative, 18; Shrunken eyeball, 17; Panophthalmitis, 9; Optic atrophy, 9; Optic neuritis, 2; Iridochoroiditis, 1; Staphyloma corneæ, 8; Staphyloma scleræ, 1; Keratoconus, 4; Retinal hemorrhage, 1; Amaurosis, undetermined, 1.

CONCLUSION.

We cannot make as yet any definite conclusion. An investigation of this nature should be made for several years,

and extended throughout the whole archipelago. We as medical men should take it as a duty to our country to study the causes of blindness and to formulate and recommend suitable measures for its prevention.

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A REPORT OF THREE CASES OF TUBERCULOSIS OF THE CONJUNCTIVA.[1]

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UP to the present time, I do not know of any record of ocular tuberculosis that has been published in these Islands. There is no doubt that tuberculosis of the eye, especially that of the conjunctiva, is rather a rare affection but nevertheless it is hard to believe that it does not altogether occur among our people, as it appears to be, especially if we take into consideration how prevalent the pulmonary form of the disease is here and how very poorly the people observe preventive measures for its spread. In order to correct, in a way, this erroneous impression I took up the report of these three cases that came to our observation since 1920. During the years 1920 and 1921, there were treated in the dispensary of the Philippine General Hospital 5,604 eye cases, only 2 of which were found to be tuberculosis of the conjunctiva. Case 3 in this report came to the hospital only on January 1st of this year.

Case 1.—A female child, 8 years of age, was admitted to the surgical department of the Philippine General Hospital because of enlarged suppurating lymphatic glands in the neck and preauricular region of the right side, and with ulcerations in the right eye. The ocular trouble was referred to our department for diagnosis and treatment. The eye lesion was said to have been one year before her admis-

[1] Read before the Fifth Medico-Pharmaceutical Congress of the Philippine Islands, 1922, Section on Ophthalmology and Oto-Rhinolaryngology.

sion to the hospital after some foreign body (dust particle) has entered the eye. The patient did not complain of much pain from the eye but rather came to the hospital because of the lesion in the neck. The suppuration of the cervical lymphatic glands was of six months' duration. The family history was negative for tuberculosis. Upon examination of the right eye there was found extensive infiltrated and ulcerated area on both the bulbar and palpebral conjunctiva. The lesions involved also the cornea. The surface of the ulcers was covered with yellowish muco-purulent discharge which on being wiped out presented a base in the form of unhealthy granulation tissue. In view of the great extent of the lesion in the eye the only advice that could be given at that time was enucleation of the eyeball. In this case the extensive ulceration of the eye together with the glandular involvement of the neck and preauricular region did not offer great difficulty in making the diagnosis. X-ray examination of the lungs showed enlarged peribronchial glands. The eye was enucleated and it was surprising to notice how the adenitis gradually subsided and the patient was discharged with a good healed up stump in the right eye socket and healed up scars in the neck two and a half months after the operation. On December 13, 1921, this child came back with inflammation of the inner canthus of the right eye and a lacrimal fistula discharging thin purulent secretion. This appears to be an extension of the former eye affection. Only medical treatment was instituted in the form of an eye wash and instillation of silver nitrate solution 2%.

CASE 2.—A young man, 19 years old, was admitted to the hospital June 14, 1920, because of redness and lacrimation of the right eye of three years' duration. The patient stated that his eye trouble started after the entrance of a foreign body in that eye. He first felt pain in the upper lid, later on there was redness and lacrimation and then pain also in the lower lid. On examination the bulbar conjunctiva was congested and on everting the lids (which was done with great difficulty) there was found ulceration and hypertrophied granulation in the fornices of both lids. There was also a small amount of muco-purulent discharge in the conjunctival sac. The cornea was apparently normal. The vision not impaired. Left eye was normal. This individual was strong, well developed, and well nourished, with negative findings in the lungs upon auscultation and percussion. X-ray showed dense shadow at the hilus. The cervical lymphatic glands were not enlarged. Von Pirquet reaction was negative. The ulcers of the conjunctiva were cauter-

rized with copper sulphate stick, but very little improvement was obtained. No other examination could be made on this patient nor other treatment given because he insisted on going home to the province. About a year later (July 26, 1921) this same patient was again admitted, this time with a very advanced eye lesion. The lids were puffy and there was a sort of pannus covering the cornea. The ulceration has extended over the whole bulbar conjunctiva. The ulcerated area had the appearance of granulation tissue. There was profuse lacrimation and the patient was complaining of much pain. The left eye, however, was apparently unaffected.

The appearence of the eye lesion and its slow progress were suggestive of a tuberculous process. Smear from the discharge from the eye was negative for acid fast bacilli. Section from the ulcerated bulbar conjunctiva was histologically examined and was reported to be tuberculosis. Deep X-ray therapy was given three times, later on thermocautery was employed, but both forms of treatment gave unsatisfactory results. As the lesion in the eye was already very extensive and the patient was suffering from much pain and headache enucleation was proposed to which the patient readily consented. The stump healed after one month but the discharge continued. He was then treated in the dispensary where he was advised to expose the stump of that enucleated eye to direct sunlight for from 2 to 5 minutes daily. The discharge apparently diminished and the patient said he felt better. Constitutional treatment in the form of tonics has been given.

Case 3.—Patient was admitted only last January 1st. The patient was a woman 32 years old who came with extensive ulceration of the palpebral and tarsal conjunctiva of the right eye, corneal involvement and loss of vision in the same eye. In the lids of the left eye there was hypertrophy of the tarsal conjunctiva with cicatricial changes at the margins, those in the lower lid giving rise to slight entropion, and as a result of which a small ulcer was produced at the lower portion of the cornea due to the constant rubbing of the turned in cilia. The discharge was abundant, yellowish, muco-purulent. The lids of the right eye were very much thickened and infiltrated. Vision was negative in this eye. The ulcerations in the right eye were of three months' standing. Examination of the lungs revealed some impairment of resonance at the apices. X-ray showed scattered shadows in the lung field specially in the left apex suggestive of t. b. in the words of the roentgenologist. Smears from the conjunctival sac were negative for acid fast bacilli. Section from the bulbar portion of the ulcerated

conjunctiva showed the lesion to be tuberculous in nature. The patient refused surgical treatment. Instillation of silver nitrate 2% sol. was given, and as not much improvement was observed heliotherapy was tried. The right eye with lids everted was exposed to direct sunlight for 5 minutes twice daily. Six days after there was noticed a marked diminution of the secretion and the hypertrophied granulation appeared more flattened. The patient insisted in going home before this treatment was over.

Tuberculosis of the conjunctiva occurs in a variety of form and according to Eyre 5 types have been described: (1) The ulcerative form. (2) Miliary tubercle. (3) Hypertrophic granulation. (4) Lupus. (5) Pedunculated tumor. All of our cases appear to be of the ulcerative type, although the bases of the ulcer resemble granulation tissue. This variety of manifestation of the disease when affecting the conjunctiva, may account in part for the apparent rarity of these cases as some may have probably been overlooked or confused with other affections.

CONCLUSIONS.

It is evident that from the number of cases here represented no conclusion can be drawn as to age, or sex incidence, but all three cases occurred in patients under 35 years of age.

As to diagnosis, the smears from the eye discharge have always failed to show the tubercle bacilli, and the only conclusive means of diagnosis in two of our cases has been the histological examination of section from the lesion.

In the two cases where heliotherapy had been employed we obtained some indications of improvement. However, I abstain from giving any conclusive opinion as to the value of sunlight in the treatment of these cases as my experience in it it as yet very meager. George Libby of Denver reported good results from heliotherapy in combination with tuberculin injection, and he cited the case of a medical student in Switzerland whose eye has been infected with tubercle bacilli in opening an abscess, where complete cure took place by exposure to direct sunlight only without the use of tuberculin.

In all three cases the right eye was the only one involved

although in Case 3 some cicatricial changes have been found in the lids of the left eye.

The ocular lesions in these cases appear to be secondary inasmuch as certain signs of lung involvement have been found in them, although in Case 2 these were very doubtful as only density at the region of the hilus was discovered by X-ray examination.

INTRAOCULAR FOREIGN BODY.[1]

By Dr. L. D. BROSE, Evansville, Ind.

THE prognosis in eye injury, the result of intraocular foreign body, depends upon the nature of the foreign body, the eye structures injured, the seat of lodgment of the body, and the degree of infection it carries. Lead, especially the smaller shot, may enter the anterior part of the eye, pass through the eye chambers, reperforate the eye, and come to lodgment in the orbital tissues with the preservation of fair vision. I have met with such cases. However, a shot coming to arrest in the vitreous chamber is not well tolerated and it is my experience that such eyes must sooner or later be enucleated. The lens, on the other hand, tolerates most foreign bodies well, although it readily becomes cataractous. Particles of glass and stone are likewise at times well tolerated through becoming encysted. Copper, when it is arrested intraocularly outside of the lens, is badly tolerated and a particle of aseptic copper, if permitted to remain in the iris, ciliary body, or vitreous, sooner or later, because of chemical changes which take place, gives rise to pus formation. I recall a particularly sad case of intraocular injury through copper and glass, that of a five-year-old boy who pounded a cartridge in a glass vessel causing it to explode with the result that numerous particles of copper and glass perforated the cornea. I advised enucleation of the eye but the father objected, saying I had treated an eye injury in the son of a prosperous near neighbor and did not remove the eye and now because he was a poor man I wished to take his son's eye out. Notwith-

[1] Read before the First Indiana Councilor District Medical Society, May 9, 1922.

standing my explaining the difference in the nature of the two injuries and warning him of the danger of the good eye becoming diseased through sympathy he remained obdurate with the result that the boy became incurably blind in both eyes within twelve months. The introduction of the radiogram and the improved large magnet have been of the greatest help to the oculist, both in diagnosis and treatment of these injuries. I have recently had an interesting example of copper in the posterior aqueous chamber, where a radiogram was of great service.

The patient, a boy twelve years of age and living at Birdseye, Ind., on Sept. 1, 1921, exploded a dynamite cap lacerating the left hand and injuring the left eye. I saw him on Sept. 25th and a careful examination established the following. In the upper and outer corneal quadrant a lacerated wound with which the iris was adherent causing an irregular pupil. The lens was partially cataractous and vision reduced to the counting of fingers directly in front of eye. He was admitted to the Walker Hospital where a radiogram by Dr. Baker verified the diagnosis of foreign body and localized it 3*mm* above a horizontal plane of the cornea, 5*mm* to temporal side of vertical plane and 6*mm* back of corneal center. Under general anæsthesia the anterior chamber was opened with the keratome at the indicated point, an iris forceps inserted through the lacerated iris wound into the posterior aqueous chamber, and at our second attempt the forceps was felt in contact with the foreign body and we successfully removed the particle of copper. The eye healed kindly and the lens is gradually being absorbed so that when last seen on Nov. 13, 1921, he counted fingers at six feet.

In the following case the X-ray and the magnet were in turn serviceable.

Myrtle H., æt 10 years and residing at Winslow, Indiana, was brought to me by her father on January 16, 1919. She had been pounding with a steel hammer when the left eye was injured some three weeks ago. I found a small grayish opacity in the cornea to the outer side of the pupil, a cataractous lens, and vision reduced to good light projection. A radiogram confirmed our diagnosis of intraocular foreign body. On January 25th, after rendering the cornea anæsthetic with 1% solution of holocaine and with

the assistance of Dr. M. Ravdin, the eye was brought in contact with the giant magnet and in a few seconds the particle of steel came forward into the anterior chamber from whence it was removed by the small magnet through an opening made at the corneal periphery. The eye healed rapidly and vision is again restorable with removal of the traumatic cataract.

The radiogram may fail to establish the presence of an intraocular foreign body, either because the body is a very small one or the picture taken is faulty. The large magnet may, nevertheless, be successfully used as was done in the following patient:

Claude O. Flynn, æt. 60 years, and residing at Owensboro, Ky., was sent to me on May 30th, by Dr. J. H. Thorpe. He injured the right eye while using a hatchet, experiencing sudden pain and loss of sight. Focal examination revealed a faint grayish corneal opacity in the upper corneal quadrant; a small underlying iris injury with posterior synechia and a cataractous lens. Notwithstanding an X-ray picture was negative, we still held to our diagnosis of intraocular foreign body. The eye was rendered non-sensative by holocaine and brought in contact with the giant magnet, Dr. M. Ravdin assisting. At the third attempt the particle of steel came forward into the anterior chamber from whence it was recovered by the hand magnet through an opening made in the corneal periphery. The iris, which appeared in the wound, was reposed, the eye bandaged, eserin instilled, and the patient requested to enter a hospital and remain in the city a few days. Instead, he returned to his home and Dr. Thorpe wrote me some six weeks later that the eye healed without complication and that vision can be restored with removal of the cataractous lens. The steel recovered was scant 1*mm* in length and less than that in width.

It is possible to make a diagnosis of intraocular foreign body without the aid of the X-ray, without the help of the magnet, and without a history of eye injury as was done in the following patient.

Mr. W. C. B., æt. 28 years, and residing at Mounts, Ind., consulted me on June 12, 1897, for a badly inflamed and painful right eye. He had been under treatment by an oculist for eye inflammation and at the end of two weeks

the oculist leaving the city for a vacation directed him to return to his home and continue the use of atropin. The pain becoming unbearable he at once returned to the city and thus came into my hands. I found an intense iridocyclitis, the iris discolored, the aqueous turbid, pupil contracted, and a small hypopyon. Vision was reduced to good light projection except in the upper anterior retinal region. He could give no reason for the inflamed eye. Upon careful focal illumination I detected in the upper outer mid-corneal quadrant a very faint grayish line-like opacity and gave the diagnosis of intraocular foreign body. With this, the patient recalled that a day or two previous to the eye inflaming he had handled iron hoops and after pounding upon one with a hammer he suddenly experienced momentary sharp pain but continued at his work and forgot about it. I advised that the eye be enucleated, to which he consented. The removed eye was sectioned and a particle of rusty iron found in the posterior aqueous chamber embedded in pus. Recovery was uninterrupted and he has remained a very grateful patient.

In the diagnosis of intraocular foreign body we consider the history of the patient, examine the cornea and sclera for entrance wound, note whether the pupil is regular or not in contour, if the iris is injured, whether the lens is cloudy or not, and follow this if the intraocular media permit by careful opthalmoscopic fundus examination. The retina and choroid may disclose rupture, hemorrhage, detachment, and later pigment changes. A foreign body in the fundus embedded in blood extravasate and fibrin may be mistaken for an inflammatory exudate. Particles of iron and steel after a time give rise to other evidence termed siderosis bulbi. This we recognize through gradual rust discoloration of the tissues, occasioned by partial solution of the iron by the intraocular fluids and its diffusion and redeposition, the iris taking on a brown or greenish-brown hue, the lens capsule staining with brown ring-like discoloration. With this the retinal function is impaired and the patient complains of night blindness and discloses circular contraction of the field of vision. Hematogenous siderosis, a staining of tissues with iron containing pigments derived from the blood, must not be confounded with siderosis bulbi due to intraocular foreign body. An eyelash carried into the anterior chamber may give rise to iris cyst or carry

serious infection, the reaction following intraocular injury may result from infection carried into the eye by the foreign body or may follow a later introduction through tardy closure of the entrance wound or through infection due to prolapsed iris. A moderate degree of infection does not always mean loss of the eye. Vitreous abscess most certainly does. Hence, in our treatment we make sure not to use unclean instruments nor contaminated dressings. Where iris prolapse is recent and non-adherent, an attempt may be made to repose it. Otherwise, not only prolapsed iris but other ragged tissue presenting in the wound should be cut off. Gaping wounds in the cornea or in the sclera may be covered with conjunctiva. The injured eye should be bandaged and the patient confined to bed. The earlier the foreign body is removed from the eye interior the better the chances for retaining the eye. It is not always best to remove a magnetizable body by the anterior route with the large magnet. On the contrary, if the lens is found fairly clear and the foreign body shown to be of some size, a puncture posteriorly through the sclera is safer and readily permits of extraction of metal with the small magnet. The dragging of a large particle of steel with ragged edges through the lens, ciliary body and iris by the anterior route may so injure the eye as to destroy its usefulness and call for enucleation. Our immediate result may be apparent preservation of the eyeball and later because of repeated recurrence of intraocular inflammation we may find it necessary to remove the eye. I have had such experience in a boy who met with a perforating eye injury through a bird-shot striking the inner orbital wall and being so deflected that the globe was perforated near the equator and the shot ranged forward through the lens and iris into the anterior chamber from whence it was recovered with forceps through a peripheral corneal opening. The eye apparently healed with some sight preservation but fifteen years later I was called upon to enucleate it. With the passing of time intraocular cicatricial changes followed, the retina became detached, the eye disorganized, and lastly irido-cyclitis set up.

OCULAR PEMPHIGUS.

By Dr. LLOYD B. WHITHAM, Baltimore, Md.

PEMPHIGUS is a term of diverse clinical application: there being, firstly, the fulminating disease, acute malignant pemphigus, which occurs, usually, in those who handle decomposing carcasses, and is characterized by high fever and other symptoms, notably bullæ on the skin, mucous membranes, and conjunctiva, death, in 75% of cases, ensuing within a fortnight, due to the severity of the general infection.

Next, and oftenest confused with true pemphigus, is the more frequently seen Duhring's disease or dermatitis herpetiformis, offering a variety of pictures but definitely differentiated by its polymorphic eruption, accompanied by itching and pain, its tendency to recurrence, the fact that the patient's health remains good throughout, and, lastly, by the eosinophilia more recently emphasized.

Thirdly, there is a group of minor pemphigoid states, not at all resembling the genuine condition and, lastly, an exceedingly rare affection, pemphigus vulgaris or chronic pemphigus, by which is meant a slowly progressive and frequently fatal disease, marked by a dermatitis with successive crops of bullæ appearing upon apparently normal skin, as well as by analogous manifestations on the mucous membranes, accompanied by varied constitutional symptoms, and lasting for an indefinite period.

Pemphigus conjunctivæ has been recognized as a clinical entity for 63 years, though confused with xerosis and otherwise designated as "syndesmitis degenerativa" and "essential shrinking of the conjunctiva," respectively, causing considerable controversy until von Graefe identified the latter process

as merely a stage of pemphigus of the eye, since which many other observers have concurred in this conception.

Were not the rarity of the condition attested by the dearth of reported cases in the literature, the following table, alone, would suffice to establish the fact:—

In 200 cases of pemphigus of the skin and mucous membranes Hebra was unable to find one with ocular involvement, while Pergens's 132 collected cases showed blebs on the conjunctiva in 1.5% with essential shrinking in 12%. In 45,000 patients with ophthalmic affections Franke found 5 of ocular pemphigus, in 22,000 Pergens detected 2, among 70,000 cases Horner ran across 3, Santos Fernandos had the same number in 50,000, while Posey saw but one in a series of 75,000.

Fuchs gives a very excellent and vivid picture of this ocular disease, with which the case to be cited tallied rather closely, except that bullæ were readily and frequently observed and were larger than the small vesicles to which he refers in his book. The pathology and bacteriology are accurately described by Parsons:—

"The bullæ do not involve the whole thickness of the conjunctiva. The fluid contents are at first clear serum; later they invariably become cloudy and contain fatty-degenerated epithelial cells, leucocytes, a few red corpuscles, granular debris, and coagulum. Changes occur in the cornea which is gradually transformed into vascular scar tissue, covered by thickened, papillary, horny epithelium.

"The bacteriology of the skin (as well as that of the blebs upon the conjunctiva) has led to discordant results, and the condition is now regarded as due to the action of toxins upon the nerve centers."

Treatment, aside from the palliative, symptomatic form, has been generally unavailing. Numerous writers have made interesting and original suggestions and Wood, of Cape Town, claims success from saline irrigations with closure of the eyes, and follows the subsidence of the acute manifestations by conjunctival implants, while Gewalt and, later, Brenning, have reported curative results following turpentine injections.

Aside from the instance to be reported, the writer has seen two cases of supposed ocular pemphigus presenting the characteristic picture of phthisis conjunctivæ with hard,

opaque, scaling corneæ, binocular, which were presumed to represent late pemphigus conjunctivæ and so diagnosed in the dispensary records, and one of sub-acute pemphigus of the pharynx with essential shrinking of the conjunctiva of both eyes. The vagueness of history, the fact that the onset is often so insidious that subjects fail to apply for expert treatment until decided secondary changes have supplanted the acute phase, and the inability to definitely rule out other factors in advanced cases render such diagnoses tentative and unsatisfactory.

In July, 1917, a definitely proven ocular pemphigus, in its early stage, came under the author's observation, and, while it has, already, been touched upon in his review of the work of the advanced eye center of the American Expeditionary Forces in France, it was not deemed wise to report it until sufficient time had elapsed for corroboration by other unbiased ophthalmologists. Now, however, the case has been followed for over four years, and the diagnosis confirmed.

Private C. E. was first seen on July 31, 1917, at the Johns Hopkins Hospital Unit, Bazoilles-sur-Meuse, France.

History.—Patient complains of a sore and inflamed left eye. This eye has been a source of annoyance during the past five years; there have been periods of severe pain and inflammation, with intervals of apparent normality and freedom from any subjective or objective symptoms of disease, except that the vision has gradually failed in both eyes, though to a more noticeable degree in the left, and he remarks that it is this eye which has been, on past occasions, considerably traumatized from one cause or another. Patient had five attacks of gonorrhœal urethritis. Denies syphilis. Father and an uncle each lost an eye from causes unknown.

Present Condition—Physical examination: Thorax and abdomen negative; genitalia,—scars of numerous chancroids upon glans penis; extremities,—some scars over right tibia; reflexes,—generally increased, especially the patellar.

Left Eye.—Marked swelling of the lids, blepharospasm and photophobia, with profuse lacrymal discharge, as well as considerable muco-purulent, conjunctival secretion. There is a decided blepharitis marginalis sicca with a few small hordeoli. The palpebral conjunctiva is exceedingly engorged and swollen, the surface being red and beefy in appearance, though moist and fairly smooth. The bulbar

conjunctiva is extremely congested but not unduly chemotic. There is a large, superficial ulceration of the bulbar conjunctiva, fairly circular in outline and about 5*mm* in diameter, immediately infero-nasal to the cornea and in juxtaposition to the limbus. The ulcer appears to extend into the cornea for about 1*mm* beyond the margin, and there is a grayish-yellow infiltration, which, apparently, extends into the substantia propria, and mars the transparency. There are two small ulcers in the bulbar conjunctiva near the inferior fornix.

Treatment.—Atropine and other local remedial measures as indicated.

At this time three ætiological factors presented themselves: gonorrhœa, lues, and some rare leptothrix or fungoid infection, and, in fact, the earlier smears seemed to support the latter view.

Repeated smears and cultures were negative for any definite bacterium. Lues was partially ruled out by a negative Wassermann.

Various modifications of and actual changes in the local and systemic treatment were tried, but the condition proved most refractory to all, still more definitely ruling out lues.

August 4, 1917. Smear from ulcer failed to reveal anything definite; there were many polymorphonuclear leucocytes, a few epithelial cells, much fibrin, a few cocci, bacilli of a nondescript variety, and something that was suggestive of a streptothrix.

Urinalysis and blood tests negative.

August 26 and 27, 1917. Negative for all higher bacteria or fungi, for the gonococcus, and for the tubercle bacillus.

August 28, 1917. There is still considerable blepharospasm and local irritation. The two ulcers remarked at the inferior conjunctival fornix have practically healed. In addition to the main ulcer, noted upon the first examination, there is a small, incipient, superficial ulceration about 5*mm* supero-nasal to the cornea. Smear from this fresh ulcer negative.

September 1 and 2, 1917. More corneal ulcers noted, from which five new smears were made. Negative.

September 4, 1917. Examiner first impressed with the possibility of a pemphigoid affection because of observing the small remnant of a veil-like film still attached to the edge of a very new ulcer and which might represent the erstwhile covering of a broken bulla.

September 5, 1917. Dermatologist (Dr. Wile, of the University of Michigan) called in consultation, the following note being given by him: "General examination of the patient and a careful consideration of the history brings to

light a doubtful infection, possibly mixed, in 1909, not followed, however, by any recognizable secondary lesions. On the glans penis are numerous shallow scars, the result of previous ulcerative lesions, and over the right tibial region there are a few, small, punched-out scars, the result of some circumscribed ulcerative process. The absence of peripheral pigmentation suggests that these scars are probably the sequel to a pustular infection other than gummatous. The reflexes are markedly exaggerated in the tendons of both the arms and the legs. This latter finding, together with the history of the periods of depression and nervousness, is somewhat suggestive of a cerebral involvement. The local process in the eye impresses me as a type of the rare, recurring, bullous erythemas, which are, occasionally, limited to this membrane alone. A differential diagnosis between this condition and a recurring, superficial, ulcerative syphilide, would, in my opinion, only be possible by definitely eliminating the latter. For this reason, I would suggest lumbar puncture and a repeated blood Wassermann. In the event of the process being a syphilide, the prognosis is good, and, for this reason, a thorough therapeutic test would also seem to be indicated, even in the absence of other findings. The prognosis, in the case of a bullous erythema, is not good, particularly in the absence of any exciting cause."

September 11, 1917. Spinal fluid Wassermann negative. Cells varied from 0 to 3 per *cmm.* Pandy's test negative.

September 12, 1917. A fresh bulla having formed upon patient's conjunctiva, the dermatologist was called again, this time unequivocally diagnosing bullous erythema. Sodium bicarbonate irrigations to the eye and citrate therapy internally were tried, but with slight temporary improvement. Later, Fowler's solution internally produced no better results.

October 17, 1917. Bullæ have been recurring at somewhat longer intervals, on both bulbar and palpebral conjunctiva, sometimes, as to-day, upon both simultaneously. In the interim the conjunctiva has become drier and drier, the palpebral being boggy and of a dull, fleshy color, the bulbar of a dusky, brownish-red hue, and both have a decided lack-luster appearance. The inferior retrotarsal fold is partially obliterated and there is definite traction between the palpebral and bulbar membranes when the lower lid is everted and the patient is told to look upward.

The diagnosis of pemphigus was made, and the patient evacuated with the recommendation that he be honorably discharged, which transpired on June 15, 1918.

The man was last heard from on December 11, 1921, when he reported as follows:

"A short time after my discharge from the Army the eye cleared perceptibly but local pain was experienced when I tried to follow my former vocation which was very dusty and heavy work. When I got away from this I was all right but, through necessity, I had to go back to it and kept trying to stick it out until I became a nervous wreck.

"To-day I am perfectly all right and my sight seems normal in both eyes. The left eye can hardly be told from any normal eye except for a slight grayish color upon the lower conjunctiva about 3*mm* from the cornea. [The pseudo-professional description is due to the fact that the patient has recently become an optometrist.]

"I may mention, before closing, that, in spite of all treatment, my condition did not improve until about three months after discharge from the Army."

The author has felt impelled to present this instance of indubitable pemphigus, not only because of the possible ætiological clues in the familial eye weakness and the synchronicity of the affection with the individual's military service but inasmuch as it has shown a few features which differ from the generally prevalent, text-book conception of the disease:

In the first place, as in the case so accurately described by Posey, the condition was observed in its incipient stage, though, contrary to his experience, it progressed slowly and was unaccompanied by cutaneous lesions, the latter being, in his case, atypical and diagnosed by the two consulted dermatologists as Duhring's disease.

Secondly, and in contradistinction to the majority of reported cases, it was monocular from the outset and unaccompanied by any demonstrable pemphigoid lesions elsewhere, in or on the body.

Next, the typical bullæ, owing to the fact that the patient was seen several times during the day and night for over three months, were repeatedly and easily detected, which is not in accordance with the experience of Professor Fuchs and other well known observers; moreover, the size of the same, occasionally a half centimeter in diameter, was greater than the generally accepted dimensions, while the occasional situation, partially encroaching upon the cornea, was at variance with the descriptions of most recorders.

Lastly, though Buck tells us that the disease may remain dormant for sixteen years, the customary prognosis has not proved applicable to this case, and it now appears that the affection, neuropathic, toxic, or whatever the ætiology may be, has run a self-limited course of between eighteen months and two years, and that the patient has suffered insufficient conjunctival shrinking to preclude bulbar excursions, while his cornea is practically as sound as ever, though this observation is by no means original, inasmuch as the latter has been reported as remaining transparent for as long as twenty years.

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REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. BEN WITT KEY, Secretary.

MEETING OF JANUARY 16, 1922. DR. J. M. WHEELER, CHAIRMAN.

Dr. Alexander Duane presented a preliminary report of his studies on **binocular accommodation** with a chart showing the amount of binocular accommodation in 405 cases of all ages. The progress of binocular accommodation from year to year was sensibly like that of monocular accommodation. Binocular accommodation was usually somewhat higher; in young subjects it was regularly 1–2 D. higher, sometimes more. In adults, its minimum limit was about the same as that of the monocular accommodation; its mean was about 0.3 D. and its maximum 0.5 D. higher than in the case of monocular accommodation. This fact is particularly apparent and important in cases of presbyopes of 50 or over, whose maximum accommodation was regularly as much as 1.5 D. The curve showed that the decline of accommodation due to presbyopia took place at the same rate in women as in men.

Two cases of **recurrent retinal hemorrhages** of adolescence were reported by Dr. A. E. Davis, in which he called attention especially to the end results of these cases.

Case No. 1, F. B., aged 22, tall blond, in 1911 had vision in each eye = $\frac{20}{15}+$. Ophthalmoscope revealed in right eye large subhyaloid hemorrhage just below the macula, with smaller hemorrhages scattered throughout the fundus, marked perivasculitis, broad white bands on sides of the retinal vessels (more marked on the veins) extending from the disk to the extreme periphery of the fundus. In the left eye were a few

small retinal hemorrhages and the same perivascular condition as in the right.

The patient had reacted to tubercular tests pronouncedly, and was given tuberculin injections for about two years. Many recurrent hemorrhages took place in each eye, in spite of all treatment. Retinitis proliferans developed in each eye, with complete detachment of retina in the left eye. Right eye retained vision in inferior quadrant of temporal field, $\frac{15}{200}$. Hemorrhages ceased after two years, and this remnant of vision in right eye was maintained for eight years, when a cataract developed Nov. 30, 1921. This was extracted successfully and the patient's vision with +12 D.S. was restored to $\frac{20}{200}$.

Case No. 2. E. W., aged 19, tall slender blond, June 25, 1918, gave a positive tubercular family history, also history of sudden loss of vision in left eye one year previously. Four days before, June 20, the right eye had suddenly become almost totally blind.

Rv. = $\frac{10}{200}$.
Lv. = nil.

Right eye, retinal veins tortuous and greatly enlarged, large circular œdematous area surrounding the macula, with corresponding central scotoma. Left eye + 3 D. swelling at optic disk, retinitis proliferans in periphery of fundus, one or two small retinal hemorrhages. Positive general, local, and focal reaction to tuberculin. Tuberculin injections were continued but hemorrhages recurred, retinitis proliferans developed, detachment of retina in each eye; vision completely lost.

DISCUSSION: Dr. H. H. TYSON referred to a similar case of tubercular choroiditis with hemorrhages and retinitis striata, who gained weight and vision improved from fingers, excentric fixation, to $\frac{20}{30}$ + after a year's treatment with tuberculin.

Dr. A. E. DAVIS also reported the end results of a case of **Coats's disease** of the retina, which he had presented before the Society one year ago with extensive exudate and hemorrhages in the retina of the right eye, occupying the temporal half of the retina from the disk to the extreme periphery. Patient, aged ten, showed marked reactions to tuberculin

injections, local, focal, and general. He also gave very pronounced reaction following the Schieck test. Under tuberculin injections the exudate ceased to extend, the mass contracted with cessation of hemorrhages, and patient gained ten pounds.

DISCUSSION: Dr. M. J. SCHOENBERG said that not only tuberculin but also other toxins, protein toxins, diphtheria toxin, are capable of reactions in eyes with affections considered of tubercular nature, and he questioned if one is justified in making a definite diagnosis of ocular tuberculosis because of an ocular reaction after injection of tuberculin.

A case of **idiopathic cyst of iris** was presented by Dr. E. S. SHERMAN. The patient, male, aged 35, noticed in April, 1921, a small, dark spot in the left eye. The spot gradually increased in size and the vision became impaired. Two months previously vision in right eye = $\frac{6}{6}$, left eye = $\frac{6}{60}$, improved to $\frac{12}{18}$.

Completely filling the lower half of the space between the cornea and lens was a clear, globular mass (cyst), the anterior surface of which was partially covered with remnants of atrophic iris. The inner wall, in close contact with the lens, was yellowish gray, slightly corrugated in appearance, and was crossed by two or three fine, dark blood-vessels. The mass was 8*mm* horizontally by 4*mm* in the vertical. Lower margin of the pupil was pushed up by the cyst; under a mydriatic the pupil dilated upward. Fundus and media normal.

A fine hypodermic needle was passed through lower part of the cornea into the cyst, removing 5 or 6 minims of clear watery fluid. The cyst completely collapsed, but refilled in three weeks. After tapping the cyst, refraction of the eye was less myopic by −.75 Spherical.

DISCUSSION: Dr. H. H. TYSON referred to the cause of the change in refraction after tapping the cyst as being due to change in corneal curvature from pressure by the cyst against the cornea.

Dr. E. S. SHERMAN reported a case of **hole in the macula with rupture of the choroid.** P. T., male, aged 21, was struck in the right eye by a small stone. When seen nine days later the vitreous was filled with dark opacities. R. V. = $\frac{8}{60}$. L. V. = $\frac{6}{6}$. Three weeks later, vitreous was clear.

Slightly below and to the temporal side of the macula, was a

large choroidal rupture, V-shaped, extending upward and outward. On the lower part of the rupture were two or three small areas of pigment deposit and a patch of recent hemorrhage. Near the lower part of the choroidal tear on the side toward the disk, there was a typical, dark red, circular, sharply outlined, slightly depressed spot about ⅔ the size of the disk (hole in the macula). Vision = $\frac{6}{60}$. Eight weeks after the injury, the fundus appearance was about the same; vision = $\frac{6}{30}$.

DISCUSSION: Dr. H. H. TYSON thought the vision as stated was better than is found in these cases and in the absence of central metamorphosia, regarded its localization as not having been accurately determined.

Dr. J. W. WHITE reported two cases of **paralysis of associated movements downward:**

Case 1. J. H., male, aged 23. Mentally below normal. Negative syphilitic history. He had a left-sided hemiplegia, but no other ocular symptoms except loss of downward movement. No movement downward in either eye could be gotten by command, by fixing, or by turning head. No response to Graefe's test. No diplopia. Pupils normal. After three years there had been no change.

Case 2. A. B., aged 7. When 2½ years old had convulsions and high temperature for several days. There was an epidemic of infantile paralysis at the time. Fundi normal, v. + $\frac{20}{20}$. No attempt was made at fixation on command or on fixing the object, and on moving the head or object, fixation was not maintained. Pupils normal; fields normal; convergence less than normal.

Dr. White referred to the work of Wilbrand and Saenger, also to the studies of Spiller, and to the experiments of Tapolanski and of Bernheimer, in order to show that lesions responsible for paralysis of associated movements downward are most probably located in the corpora quadrigemina or in the oculomotor nucleus. Seven cases had been reported to date, and by the following authors: Gee, Poulard, Curson, Marie and Babinski, Basevi, Von Schroeder, and Suckling.

From his study of these cases, and the literature on the subject, Dr. White concluded that associated movements may be produced by cortical or sub-cortical centers. If

cortical the patient cannot fix on command, but will remain fixed by the fixation impulse when the object is once fixed. If nuclear there is no attempt at fixation either by command, fixation impulse, or vestibular excitation. Also that the Graefe test will prove whether the case is that of associated movements, of paralysis, or of hysteria.

DISCUSSION: Dr. ALEXANDER DUANE commented on the rarity of these conditions. He himself had not seen a case, although he had seen paralysis of upward movements. One of these was associated with symptoms evidencing a tumor of the acoustic nerve. Another was proved by Graefe's test to be supra-nuclear and was probably due to inhibition. He compared Dr. White's case of apparent paralysis of associated movements, relieved by atropine, to certain shell-shock cases of apparent paralysis of abducens which turned out to be simply a convergence spasm.

Dr. M. J. SCHOENBERG referred to a case which he reported three years ago, of paralysis of convergence and paralysis of associated movement upwards, and which he believed due to cerebrospinal lues.

Dr. KAUFMAN SCHLIVEK related the history of a boy, aged 14, headaches, vomiting, double choked disk, with paralysis of upward rotation. He suspected tumor involving the corpora quadrigemina. X-ray revealed a calculus in the pineal gland.

Dr. L. W. CRIGLER reported a case of **sarcoma of the choroid developing in an eye blinded by injury thirty years previously.**

A man, aged 69; in 1887, while working as a machinist, a piece of cast iron filing flew into his right eye penetrating the globe. Attempts at removal were unsuccessful and the eye gradually became blind. He had suffered periodic attacks of pain and inflammation, but not of sufficient severity to cause him to seek medical aid. After years of neglect, on Oct. 6, 1921, the eye presented several nodular tumors springing from the sclera in the ciliary zone, the conjunctiva stretched over them, but not adherent; cornea opaque; eyeball very hard; no light perception. Enucleation. The X-ray report for foreign body was negative; pathologist reported "large round-cell sarcoma."

Dr. Crigler pointed out that the chief interest in this case centered about the possible relationship between the develop-

ment of the growth and the trauma which occurred many years previously. Was the glaucomatous cupping of the nerve-head due to a prolonged period of hypertension antedating the onset of tumor development, or was it due to a *slowly developing tumor* which gave rise to early increase of tension? History of the case seemed to suggest the former, though if he accepted the theory of slow growth, there were points in the histology of the tumor which tended to substantiate this theory.

DISCUSSION: Dr. ANDREW A. EGGSTON stated that the sections of the extraocular masses compared with the intraocular tumor showed two distinctly different type cells. The cells of the extraocular tumor were very large, showing active mitosis. On the contrary the cells inside the eye were quite small, irregular, and appeared to be less active in proliferation. Undoubtedly pressure caused a difference in the rate of growth in the two locations. The origin of the tumor was quite definitely shown as arising from the choroid.

The causative relationship of the previous injury to the eye and the development of the sarcoma was of course one of speculation but such a relationship was logical when we know that irritation and injury in other parts of the body seem to be an ætiological factor.

Dr. BEN WITT KEY showed a case of *dermoid cyst* of the bulbar conjunctiva.

A young man, aged 20, presented a small, round, freely movable mass in the conjunctiva of the upper temporal quadrant of the right eye, midway between the lacrymal gland and the corneal limbus. Three hairs, 16*mm* long, growing out of the mass, were curled up in the upper fornix. Its unusual location and theory of development were of interest.

Dr. JOHN M. WHEELER reported a case of *pulsating exophthalmos* with ligation of the common carotid, followed by death.

Mrs. D. R., aged 62, first seen Dec. 8, 1921, gave a history of good health until one year before, when she became short of breath and was treated for myocarditis. No history of traumatism. For the past three weeks left eye had become prominent with orbital swelling, tenderness, and discoloration. She complained of a "hammering" sensation and constant

moderate pain on left side of the head with intermittent attacks of excruciating pain. There was palpable pulsation on pressure of either globe, more marked on the left side. A definite bruit could be heard anywhere on the head, but loudest over the orbital region on the left side. This was reduced by pressure of the left internal or common carotid.

Wassermann and urinalysis were negative; blood pressure, Sys.—185, Diast.—110; nasal accessory sinuses negative; ophthalmoscopic examination negative. X-ray report by Dr. Dixon was as follows: "The plates indicate marked pansinus-mucosal thickening. Tumor of the sella must be considered. Something in the line of the sphenoidal body (probably on the left side?) which interferes with the lateral projection of the sella."

While under observation for one week, all her symptoms became more pronounced, and after a consultation, ligation of the left common carotid was advised.

Under novocaine anesthesia, complete ligation of the left common carotid was performed by Dr. Eugene Poole. Prompt and complete cessation of the bruit resulted from the ligation and on the operating table the patient lost consciousness which was not regained.

Gradual but not complete recession of the globes followed. Right-sided hemiplegia developed and persisted. There was gradual rise in temperature to 103 degrees and the patient died thirty-nine hours after operation.

This case was reported especially to bring out the danger of complete ligation of the common carotid. An autopsy could not be obtained.

Recently Dr. James M. Hitzrot had been ligating the common carotid by a modification of Porta's method of partial occlusion of the common carotid. In response to inquiry he had written: "I expose the common carotid in the usual manner. Then take a strip of chromicized pig's bladder (Baer's membrane) about one half inch wide, fold it double lengthwise to make a band one quarter inch wide and sufficiently long to tie. This is then passed around the vessel twice, and tightened so that the pulsation in the artery distal to the ligature is just perceptible. The wound is then closed in the ordinary manner. If no symptoms arise the ligature is com-

pleted on the fourth day by reopening the wound and ligating distal to the previous ligature with chromic gut. If cerebral symptoms arise the ligature can be released by opening the wound. So far I have not had occasion to release the vessels as the temporary partial occlusion has not produced any untoward symptoms."

DISCUSSION: Dr. J. E. J. KING referred to two cases of pulsating exophthalmos which he had seen in the past six months, but stated that he did not think that immediate ligation of the common carotid was the most advisable procedure. He preferred to place a silver band about the artery and make compression, about half-way obliteration of the lumen, for a period of a week or so. If no untoward symptoms should develop, the lumen could be obliterated completely with the same band several days later. After this had proved that the blood supply could safely be diminished, the carotid could be permanently ligated and divided and the silver band removed. All of these procedures could easily be done under local anæsthesia.

Dr. ISAAC HARTSHORNE called attention to the age of Dr. Wheeler's case, 62 years, and the probable condition of the blood-vessels, hence the untoward result of the operation. He referred to a case, previously reported, of traumatic rupture of the internal carotid into the cavernous sinus, in which the common carotid was tied at one operation; vision recovered to $\frac{20}{40}$; no atrophy of the nerve.

Dr. BEN WITT KEY had studied three cases, one with Dr. Gruening in 1912 which was relieved of proptosis and the bruit, and vision restored to almost normal by ligation of the common carotid performed by Dr. Gruening himself. The second he had reported before the Academy in 1917 relieved by almost a constant digital pressure exerted by the patient himself over a period of ten days; bruit disappeared, proptosis receded, vision improved from $\frac{20}{100}$ to $\frac{20}{25}$. The third case was seen in 1918 and was the symptom of a most distressing head injury; the bruit disappeared after applying a Neff's clamp over the common carotid. He had made a study of the literature of these cases and had concluded that the ultimate near result of ligation of the common carotid had been, as a rule, only temporary relief, optic atrophy, or death. He preferred

pressure (digital or clamp) occlusion of the carotid, and believed it should always be employed before ligation is resorted to.

MEETING OF FEBRUARY 16, 1922.

A case of **tumor of the pituitary body** was presented by Dr. W. B. WEIDLER.

Miss M. L., aged 13, family and personal history negative. Headaches for past eight months (which had increased in severity and frequency), vomiting, restless sleep. Gradually decreasing vision for some months, but no diplopia. Bowels and urine regular; no polyuria. Apparently no recent increase in weight or in height in the last three years. Examination: urine and blood normal. Pupils were 3.5*mm*, react sluggishly to light, accommodation, and convergence. Vision O.D. = $\frac{8}{200}$ eccentric, O. S. = $\frac{6}{200}$ direct. Ophthalmoscopic examination revealed both optic nerves pale, showing progressive atrophy after a low-grade papillœdema. The fields showed bitemporal hemianopsia involving the point of fixation in the right. X-ray showed total absorption of the posterior clinoid processes with a deepening of the sella, there being a calcified mass situated to the right of the median line over the pituitary body.

Dr. W. B. WEIDLER also showed a case of **dermo-lipoma:** Mary G., aged eleven months, normal birth, no injury; several days after birth mother noticed a small pinkish mass in the outer canthus of the left eye. This had continued to grow, now about four times the size of the mass when first noticed. The tumor was freely movable and extended forward over the globe, and back on the eyeball into the socket. He said these growths were congenital, occurred usually between the insertion of the superior and external recti, and are true conjunctival growths.

DISCUSSION: Dr. GEORGE H. BELL, in discussing Dr. Weidler's case of tumor of the pituitary body, advised X-ray treatment before resorting to surgery.

In this connection he reported a case of his own,—girl, aged 18, with solid tumor which filled the sphenoidal sinuses and extended forward into the sphenoidal fissure. When first seen

by Dr. Bell, patient had optic atrophy with no vision in O.S., and beginning optic neuritis in O. D. with markedly contracted field, vision = $\frac{2}{10}$. X-ray revealed a large tumor.

Blood and spinal Wassermanns—negative; teeth and tonsils —negative. Dr. Tousey had given her X-ray treatment, in all fifty treatments.

The optic neuritis had subsided; her vision had improved to $\frac{3}{10}$ and her field in that eye had returned to normal. Dr. Bell plans to present this patient at some future meeting.

Dr. SINCLAIR TOUSEY said that these cases of pituitary tumors demand a great deal of study before making a diagnosis because of the angle at which they are viewed. Method of treatment given Dr. Bell's case had been, after applying goggles, to vary the parts of entry so as to concentrate the rays in different points of the tumor.

Dr. A. S. TENNER referred to a case previously reported operated upon by Cushing, and suggested X-ray treatment after operation.

A case of **paralysis of convergence and paresis of accommodation** was reported by Dr. G. W. VANDEGRIFT and Dr. R. R. LOSEY.

T. H. J., an ex-service man, aged twenty-nine, unmarried, dental student. Complaint: double vision for distance and near; first noticed in January, 1918, and developed gradually after a severe X-ray burn of occiput. Severe frontal and occipital headaches developed with the diplopia, but have since ceased. In childhood the patient had no infectious diseases, but was always subject to nasal catarrh. He did not walk till four years of age and had a tendency then to fall forward to the ground. Scars are present now on forehead from these accidents. In 1919, the year following the onset of diplopia, the patient experienced one month of noticeable sleepiness in daytime, with normal rest and sleep at night.

The patient was well nourished, healthy, with no evidence of organic disease. Family history of no importance, negative venereal history. Wassermann negative by two recent tests. No history of influenza or other infectious disease.

Neurological examination at Cornell Clinic as follows: Nervous system negative, except diplopia; nystagmoid movements of the eyes; occasional incoördination in conjugate

movements of eyes; pupillary reactions to light sluggish, to accommodation questionable; asymmetry of face; right side less used in smiling and in voluntary movements; "not multiple sclerosis, post encephalitis, or hysteria."

In 1918 sinuses were X-rayed with report that ethmoids were cloudy. X-ray (Feb. 15, 1922) by Dr. George Dixon reported:—Frontals fairly well developed, rather hazy. Ethmoids fairly clear. Antra slightly hazy. Nasal septum thick but fairly straight. Sphenoid region clear. Sella normal.

Vestibular tests by Dr. George McAuliffe: "to right and left exaggerated nystagmus for twenty minutes. Rotary nystagmus normal. Right and left past pointing exaggerated. Falling test results in falling to left both for left and right turning." These results suggest increased intracranial pressure.

Teeth X-rayed two months before showed very small abscess at root of upper canine.

Ocular examination: V. O. U. = $\frac{20}{40}$. Under homatropine V. O. U. = $\frac{20}{20}$ with Sph. + 1.75 D.

Media of each eye normal, fundi normal. No apparent reason for diminution of absolute vision.

Fields for color and form normal. Blind spots normal in form and outline. Pupils 3*mm* in width in ordinary illumination. Direct and consensual light reflexes normal. Accommodative convergence pupillary reactions absent.

Constant heteronymous diplopia for far and near with no increase in deviation and diplopia to right or left. Increasing exotropia as fixation point is moved towards the eyes. Movements of individual muscles normal in all directions. At six meters diplopia is corrected by prisms 2 degrees base in before each eye, overcoming the paralysis of tonic convergence, necessary to keep the eyes parallel. With visual lines rendered parallel by 2 degree prism base in O. U., 7 degrees of divergence power developed.

At the near point of 25*cm* 10 degree prism base in O. U. corrected diplopia. With distance correction (Sph. + 1.75) N. P. A. right eye 60*cm*, N. P. A. left eye 65*cm*. With the following glasses the near points of accommodation were:

Right Eye Sph. + 3.50 with prism 7 degrees base in: N. P. A. *26cm*
Left Eye Sph. + 3.50 with prism 7 degrees base in: N. P. A. *27cm.*

With this reading correction and with O. U. Sph. + 1 and prism 2 degrees base in for distance, the patient was comfortable and relieved of diplopia.

Dr. BEN WITT KEY presented a case of **atrophy of the uvea:**

Miss T. F., aged 21, history of loss of vision in left eye two years before, coming on rather suddenly till no light perception. No history of trauma or inflammation or pain in the eye, or headache during past two years. Previous medical history and personal history unimportant, family history negative.

Examination: Right eye normal. Left eye: lids, conjunctiva, and cornea normal; anterior chamber very shallow; iris dilated regularly, discolored, markedly atrophic; pigment layer of iris in ectropion and bound firmly and regularly to lens capsule; iris stroma retracted so that iris angle obliterated by it and broad band of pigment is thus exposed to view; pupil round, regular, moderately dilated and immobile; pupillary space clear. Peculiar cataractous formation of the lens was present—a central fibrous-like whirl of opacity anteriorly and continuous with an apparently soft and opaque lens substance. Tension had been 45 degrees (Schiotz).

It seemed reasonable to assume that there had occurred here an iridocyclitis (traumatic or other); increased tension had complicated, atrophy of the uvea followed in the usual course of events. Atrophy of the iris stroma with retraction of it and ectropion of the pigment layer, preservation of the pupillary margin of the iris; and the extent of the exposed pigment layer seemed of special interest.

Dr. D. H. WIESNER showed two cases of exudative choroiditis, which he believed presented unusual forms of pigmentation, perhaps of some pathologic significance.

DISCUSSION: Dr. A. S. TENNER referred to these cases as being of the most common type of choroiditis, and in which during the active stage of the process the choroidal pigment is absorbed almost entirely; later proliferation of pigment begins as the inflammation subsides, the late pigment deposit

depending not upon the activity of the process but upon the coloration of the individual.

The paper of the evening was presented by Dr. W. H. BROWN (Rockefeller Institute of Medical Research) on **syphilitic infection of the eye in rabbits.**

In discussing the subject of syphilitic infections of the eye in laboratory animals, attention was called to the fact that although the eye had played a prominent part in early transmission experiments, and in the subsequent growth of our knowledge of the experimental disease, the studies thus far carried out had been conducted chiefly from the standpoint of the pathologist rather than from that of the ophthalmologist. Historically, the inoculation of the eye of the rabbit by Haensel in 1881 was ranked with the transmission experiments of Klebs in the monkey and the final demonstration of the transmissibility of syphilis to the rabbit by Bertarelli in 1906 opened up a vast field for experimental investigation. The work of earlier investigators showed that the eye was highly susceptible to primary infection and it was soon found that when inoculations were made elsewhere, there was also a liability to the development of metastatic infections, especially in the cornea. Eventually, it was found that a variety of pathological conditions could be produced in the rabbit which were analogous in many respects to syphilitic affections seen in the eye of man.

These conditions were divided into two groups, the first of which included the better known affections such as those of the conjunctiva and episcleral tissues, the cornea, and the iris and ciliary body; the second group included affections of deeper structures such as the choroid and retina. A brief description of these conditions was given, accompanied by illustrations.

Among the features of eye infections which were regarded as of especial interest, attention was directed to certain peculiarities of the clinical history, to anatomical relations of the lesions, and to variations in the incidence of eye infections under different experimental conditions. Keratitis, iritis, or iridocyclitis were described as terminal events in the usual course of the experimental disease; they were usually of short duration but prone to relapse and rarely left any permanent mark of injury. These conditions were attributed to the high resistance of the rabbit as contrasted with that of man and to

the imperfect development of immunity in the eye as compared with other tissues of the animal body. It was further stated that infections of the cornea, iris, and ciliary body had a common point of origin—an infection centered about the anterior ciliary vessels at the sclero-corneal junction—the condition presented in any given instance depending upon the direction in which the infection extended.

Referring to the incidence of eye infections, it was said that this class of affections was subject to wide variation. It appeared that infection of the eyes was more prone to occur with some strains of **Treponema pallidum** than with others and that the incidence of infection with a given strain might be increased or decreased by varying experimental conditions.

Finally, reference was made to the importance of the eye as a portal of entry for syphilitic infection with or without the production of a primary lesion. In this connection experiments were described which showed that instillation of a fluid medium containing **Treponema pallidum** into the conjunctival sac of normal rabbits invariably gave rise to infection even though no injury of the conjunctiva could be demonstrated. In some instances, a lesion appeared at the portal of entry, but in others there was no gross lesion—infection being recognized by the development of lesions in other parts of the body.

For a more detailed account of the topics discussed, the reader is referred to the following papers by Brown and Pearce: *Jour. Exper. Med.*, 1921, xxxiv., 167; *Arch. Dermat. Syphil.*, 1921, iii., 254; *Proc. Soc. Exper. Biol. Med.*, 1921, xviii., 200.

DISCUSSION: Dr. MARTIN COHEN asked why Dr. Brown made the injections into the testicle and scrotum in preference to the method usually employed—into the veins.

Dr. A. KNAPP remarked on the dissimilarity of the lesions presented as occurring in the rabbit (especially those of the conjunctiva and episclera), and those commonly found in the human eye (interstitial keratitis, etc.), and asked if the difference in the blood supply of the rabbit's eye might account for this.

Dr. W. H. Brown stated that he was uncertain as to the cause of the conjunctival and episcleral lesions being fairly

common in rabbits. He had used the skin or testicle of the rabbit as means of entrance for the injections because of the convenience of this method. He had had one animal born of syphilitic parents with interstitial keratitis from birth.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. H. DICKINSON, London.

An ordinary meeting of the Section took place on Friday, March 10th, with its President, Dr. James Taylor, in the chair.

Cases.

Circinate Retinitis with Excavation of Disk.

Dr. Rayner Batten showed a female patient with a large white circular patch on the nasal side of the disk, somewhat resembling retinitis circinata. She also had a very deep glaucomatous disk, the disk cupping having been observed while she was under observation. In 1916 the vision in the right eye was $\frac{6}{9}$ and tension, pupil and optic disk were normal. In April, 1916, she complained that for six days she had had pain and the fundus could not then be seen, owing to vitreous opacities. In July, 1921, this vitreous had cleared, and then the present condition of fundus was seen. At no time was the tension of the eye above the normal; therefore he considered that cupping of the disk was due to something other than an increased tension.

Mr. Harrison Butler thought this might be a case of cavernous atrophy of the optic disk.

Bilateral Enlargement of Lachrymal Glands.

Mr. Thorpe showed a case of this condition in a girl, who a month ago came complaining that the enlargement had lasted five weeks. There had been no salivary gland enlargement. It commenced on the right side, and in a few days had

extended to the left. There was also conjunctival chemosis, and the eyelids were closed. There was now a tendency to improve. In a blood count the red cells were found to be normal, the whites were 14320, hæmoglobin 75%, polymorphs 43%, eosinophiles 18%, lymphocytes 38%, mononuclears 1%; there were no masked cells. The color-index was .85. Though the eosinophilia suggested filaria loa, no nematode worm was discovered. There was no reason to suspect neoplasm, and his view was that the condition was tuberculous.

Mr. LESLIE PATON drew attention to the report of a case of double enlargement of lacrymal glands in the February issue of *The American Journal of Ophthalmology*. He described a case of his own, in a woman of about 40, for whom, as she was importunate, he operated and removed the glands, finding they were the seat of a simple inflammation.

The PRESIDENT spoke of a remarkable enlargement of parotid, salivary, and lacrymal glands following the taking of only 20 grs. of iodide of potassium; the swelling of them quite closed the eyes. After a time a further trial of iodide was made, starting with only 5 grs. three times daily, but the trouble following the second dose was even greater.

Specific Degeneration of Retina.

Mr. LINDSAY RAE showed a boy who, having been blind a year, since he was 6, had latterly been able to perceive bright light. The Wassermann was definitely positive. He proposed to give salvarsan intravenously.

He also showed, for diagnosis, a case of either retinitis or choroiditis. With the best correction the vision could not be got beyond $\frac{6}{12}$. She had had ten septic teeth removed.

Mr. MALCOLM HEPBURN drew attention to a large linear vitreous opacity, which might be a vitreous hemorrhage, with some fibrous degeneration over the retina. He regarded it as a choroidal condition.

An Unusual Condition of Retinal Arteries.

Mr. GRIMSDALE showed a patient with loops of vessels which he considered had a connection with the hyaloid artery, and

the lower branch of the arteria centralis retinæ. A brother was similarly affected.

Colored Vision.

Mr. P. G. DOYNE, in a paper on this subject, said colored vision was associated with a variety of conditions, physical and pathological, the most generally familiar form being, perhaps, that following exposure to snow, or which may appear to those who have had cataractous lenses removed. Mr. Work Dodd described, in volume xix. of the *Transactions* of the Ophthalmological Society, a state of green vision in a man the subject of tabes dorsalis, and in the next volume he presented records of 13 cases of the condition; 3 of them had lead poisoning, 3 were myopic, 1 had detachment of retina, 1 had tabes, in 3 there was active choroiditis, 2 had migraine, 1 had wound of the cornea with prolapse of iris. In one no details were available. Mr. Treacher Collins had told him, the speaker, that colored vision might be associated with (1) changes in the visual media of the eye, (2) after images, (3) might depend on the position in which light impinges on the eye, (4) pathological retinal and nerve irritation, (5) cortical disturbance, (6) functional.

During the last few months Mr. Doyne had collected 11 cases of various forms of colored vision, and of these he gave the leading features as described by the patients. These may be summarized as follows:

CASE 1. Male, æt. 65; vision $\frac{6}{9}$ in each eye (with correction). For a few months had noticed a dark red area in the center of the field of vision when awaking in the morning, and, to a less extent, at dusk. This cloud lasted 20 minutes, then faded away; he could see through the cloud. There was some sclerosis of the choroidal vessels, and in the macular area a clearly defined zone of colloid body formation.

CASE 2. Female, æt. 68. Occasionally had blood-red clouds in front of the eyes, and sometimes saw an appearance as of blood on her handkerchief. Had had the condition three years, but more markedly during the last 3 months. With correction, vision was respectively $\frac{6}{12}$ and $\frac{6}{18}$; a few peripheral striæ were in each lens. At the macula there was a condition like that in Case 1.

CASE 3. Female, aged 41. Had ptosis of the right eye, and some scattered lens opacities in each eye; disks were pale and the Wassermann was positive. Diplopia was complained of, but ocular palsy could not be detected. No lesion of the central nervous system could be discovered. She saw a red ring, inside which were various colors, *i. e.*, blue, green, yellow.

CASE 4. Female, aged 45. The right eye was blind. With a minus 16 in front of the left eye she could count fingers, and in this eye was a big detachment of retina, up and out. One day on going out on to the hospital verandah, "everything went red," and this persisted 45 minutes after she returned into the shade.

CASE 5. Female, aged 60, a case of erythropsia following upon extraction with iridectomy, the symptoms having appeared three months after the operation.

CASE 6. Female, aged 37, who had marked bilateral optic atrophy, dilated pupils, a strongly positive Wassermann, and some dulling to deep and superficial pain in the legs. She had bare perception of light. A month ago, suddenly, after dinner, everything became a brilliant red, as if a red curtain had been drawn before the eyes. Ten days later she reported that it had disappeared, and given place to a gray cloud.

CASE 7. Female, æt, 18, with 5 D. myopia, with this corrected she read $\frac{6}{12}$ with right and left. For two months she had been seeing colors flash past her eyes when moving her head. Mostly purple was seen, but sometimes black, and occasionally other colors. This type Mr. Doyne believed to be sometimes found in cases of retinitis pigmentosa. This patient's visual fields were quite full; there was no night-blindness, and the fundi did not suggest that disease.

CASE 8. Male, æt. 23. In the macular area of the right eye there was a gray change dragging upon the retina and producing radiating folds in it. In the retina peripherally there was much glistening from the interior limiting membrane, and there were dots above and below the disk. Both daylight and bright electric lights troubled him. When tired, he noticed a purple cloud in front of the right eye, and it had a bright yellow margin: after lasting some time, the cloud broke up into smaller ones and then disappeared. Whatever color the cloud started with, it always reverted to purple.

CASE 9. Female, aged 26, who for six months had had a cloud in front of the right eye (the left was blind). The cloud appeared suddenly, was first red, then green, then black. It appeared only in the daytime. The right eye appeared normal.

CASE 10. Male, aged 45, a well-marked case of tabes, with optic atrophy. Four months ago he noticed a red mist in front of his sight, and in time it became a darker red.

CASE 11. Male, aged 38, whose left eye was blind, and the right had 6 D. of myopia, and during the last few days had been failing. A fair-sized hemorrhage at the macula could be seen, with smaller outlying ones. The patient described seeing a black ring in front of the eye, and when he shut his eyes, he could see a green ball.

Mr. DOYNE said the two cases which interested him most were those having the colloid body formation, as the ophthalmoscopic appearance in these was so definite and the area of change so clearly defined. Yet this type of degeneration was not uncommon, and he was not aware that red vision was usually associated with it. In the first of the related cases the phenomenon was noticed on first waking and in twilight, *i. e.*, times when a change in the stimulation of the retina was taking place. He asked whether, on the assumption that the colloid body formation interfered somewhat with the nutrition of the retina, it could be reasonably supposed that the retinal elements, which was stimulated by red rays, had a lower threshold.

Mr. M. S. MAYOU related a case of the kind which he had had, the subject being a taxi-cab driver, and he dare not take his car out at night as he saw approaching lights as a red wall, and could not discern whether lights were approaching or receding. Nothing wrong was found in the fundus, but probably there was present some arteriosclerosis. He was about 50 years of age. He got much better in 4 months, and resumed work.

Mr. LESLIE PATON spoke of the number of cases of tabes which reported having green vision, and the small number who saw red. One or two tabetics were recorded as having purple vision, and some had a green meshwork with a purple field. In the transient amaurosis associated with cerebral tumor definite color scotomata were recorded. Cases of migrains

sometimes saw flashes of purple balls in a green field, and green balls in a purple field.

The PRESIDENT referred to cases of optic atrophy in which a pale blue mist came over the eyes with the onset of twilight.

Mr. FRANK JULER spoke of a case of his in which a medical man had his cataract extracted, and five months later said he had purple vision. The patient's own suggestion as to the cause was that some change had been induced in the reaction of the visual purple by the excess of blood which got in, a disturbance of the vitreous probably acting chemically on the retina; not a fatigue phenomenon, as it was worst when first awaking in the morning.

Mr. R. A. GREEVES spoke of a patient under his care who had central cataracts, and to whom he gave weak atropine drops; but she discontinued using them because when she went out of doors everything looked green, and when she returned the home looked red.

Mr. W. T. HOLMES SPICER remarked on the fact that immediately after cataracts were removed the patients saw everything blue. Subjects of retinal hemorrhages saw patches of blood in their own retinæ. A sudden drag on the eye muscles produced, in him, a brilliant-edged purple light. Fuchs said that after a cataract extraction the eye had no longer the protection of the semi-opaque lens, and when it entered a bright area, such as amid a fall of snow, erythropsia resulted; that the bright dazzle exhausted the visual purple, and there followed a rapid re-secretion of visual purple.

Mr. R. R. CRUISE suggested that in patients at or past middle life arteriosclerosis might be a causative factor.

Mr. DOYNE replied.

PAPER.

Mr. R. AFFLECK GREEVES: **A Series of Sympathizing Eyes Examined Microscopically.**

Mr. Greeves said only a few observations had been made on the sympathizing eye, though many were made on the exciting eye in sympathetic ophthalmia. Fuchs, in 1893, sought to show that the microscopical changes in the exciting eye

were so constant as to enable a diagnosis to be made merely from the sections of the eye. Most books stated that the changes in the sympathizing eye were identical with those in the exciting eye. In two cases which he had examined, however, there was a definite difference, and he now demonstrated on the screen sections from ten cases. These showed that the character and extent of the inflammatory changes did not depend on the duration, nor on the period between the injury to the exciting eye and the onset of the trouble in the sympathizing eye. In four of the cases the infiltrating cells were purely lymphocytes and plasma cells; in five epithelioid cells were present, and in three of the five a few giant cells. The only constant factor in all the cases was irido-cyclitis, varying in intensity and character in different cases. In five cases in which the cornea was infiltrated the infiltrating cells were lymphocytes and plasma cells; there were no giant cells. The posterior part of the choroid was never more densely infiltrated than the anterior, which was the rule in exciting eyes. There was some involvement of vitreous. The optic nerve was normal in three cases, œdematous in five, and in only one case was the nerve sheath infiltrated. In three cases, which had not been operated upon, there was rupture of the lens capsule, and in two of these the iris and the swollen lens matter formed a necrotic mass. In these two the tension of the eye was low, in the third there was the usual secondary glaucoma. Organized plastic exudation was present in four cases, and this fact was against Fuchs' view that plastic exudation in sympathetic disease, which was invariably present in exciting eyes, was due to a secondary infection, and not part of the actual process. The cases showed that there was no special characteristic of the sympathetic process, as shown by the microscope, which was of constant occurrence in sympathizing eyes.

Mr. M. S. MAYOU spoke of deposits beneath the epithelium in cases of sympathetic ophthalmia, and he showed slides of two cases which demonstrated this; there was a deposit of fibrous tissue between the epithelium and Bowman's membrane.

NOTICE.

The undersigned beg to announce the establishment of a special course for postgraduate study in OPHTHALMOLOGY, to be given during eight weeks between October 2 and November 25, 1922, at the I and II EYE CLINIC of the Allgemeines Krankenhaus, Vienna.

Prof. Meller and Prof. Dimmer, chiefs of the clinics, have consented to active participation. In addition Dr. Bachstez and Dr. Lindner and Dr. Guist of the II EYE CLINIC will give courses. Dr. Hirsch and Dr. Kummer will lecture on the hypophysis and on radium in relation to the eye. The entire material of both clinics will be at the disposal of the staff for the purposes of instruction and demonstration. The course has been so arranged that in the two months period the field can be covered in quite a systematic and fairly comprehensive way. A weekly colloquium attended by all members of the staff and class will provide for an exchange of opinion and discussion.

The entire course will be in English. The fee will be $200.00. Application, with certified check or draft in dollars to the amount of $50.00, should be in the hands of Dr. Adalbert Fuchs, I. Augenklinik, IX. Alserstrasse, 4, Vienna, by August 15th. The course will be given for a minimum of ten, and a maximum of fifteen members. As early an application as possible is therefore advisable. The detailed plan of the course follows:

Hofrat Dimmer	Photography of the Fundus	2 hours
Prof. Meller	Operations	30 "
" "	General Diagnosic	10 "
Doz. Lauber	Physiology and optics	20 "
" "	Examinations (Red-free Light Slit-lamp)	28 "

Doz. Lindner	Refraction	20	"
" "	Bacteriology	20	"
" "	Retinoscopy	8	"
Doz. Hirsch	Hypophysis	2	"
Doz. Kummer	Radium Therapy	1	"
Doz. Bachstez	Muscles	20	"
" "	Neurology	8	"
" "	External Diseases	28	"
Doz. Fuchs	Anatomy of the Orbit	8	"
" "	Normal Histology	10	"
" "	Pathological Histology	30	"
" "	General Therapeutics and Local Anæsthetics	3	"
Dr. Guist	Ophthalmoscopy	40	"
Doz. A. Fuchs and Doz. Lindner	Colloquium, one evening each week		

E. FUCHS.